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APPENDIX 3 - SUMMARY OF ANTIMICROBIAL AND MULTIDRUG RESISTANCE IN BACTERIA/ FOOD COMBINATIONS OF INTEREST IN ELIGIBLE STUDIES

1. Pork meat

S. Derby

Table 3.1: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Derby isolates from pork meat

Food item	Number of food samples	Number of isolates	PENICILLINS		3RD GEN CEPHALOSPRORINS		(FLUORO)QUINOLONES		POLYMYXINS	Country	Year	References
			% AMC	% AMP	% CAZ	% CTX	% CIP	% NAL	% CST			
Pork meat & offal	1,440	8[*1]	--	0	--	--	0	0	--	**United Kingdom**	2003-2005	[1]
Pork meat	1,693	1[*1]	--	0	--	--	--	--	--	**United Kingdom**	2006	[2]
Pork meat	170	1[*1]	--	0	0	0	0	0	--	Czech Republic	2013	[3]
Pork meat	27	27	--	0	--	--	--	--	0	France	2006-2007	[4]
Pork meat	N/S	12	0	8.3	--	--	0	0	0	Germany	2006-2007	[5]
Pork meat	197	1[*1]	--	0	0	0	0	0	--	Ireland	2007	[6]
Pork meat	170	12	--	0	0	0	0	0	--	Italy	2012	[7]
Pork meat	170	5[*1]	--	0	0	0	0	0	--	Latvia	2013	[3]
Pork meat	170	8[*1]	--	1	--	0	0	0	--	Romania	2012	[7]
Mince meat	170	3[*1]	--	0	--	0	0	--	--	Romania	2012	[7]

AMC- Amoxicillin- clavulanic acid; **AMP**- ampicillin; **CAZ**- ceftazidime; **CIP**- ciprofloxacin; **CST-** colistin; **CTX**- cefotaxime; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.2: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Derby isolates from pork meat

Note: resistance to polymyxins was not explored in eligible studies

Number of food samples	Number of isolates	PENICILLINS		1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS		(FLUORO) QUINOLONES		MACROLIDES	Country	Year	References
		% AMC	% AMP	% CEF	% FOX	% CFT	% CRO	% CIP	% NAL	% AZM			
75	1[*1]	--	--	--	--	--	0	--	--	--	Canada	2002	[8]
50	1[*1]	0	0	0	--	0	0	0	0	--	United States	1998[*2]	[10]
N/S	4[*1]	0	0	--	0	0	0	0	0	--	United States	2006	[9]
N/S	3[*1]	0	0	--	0	0	0	0	0	--	United States	2009	[9]
N/S	6[*1]	0	0	--	0	0	0	0	0	--	United States	2010	[9]
N/S	2[*1]	0	0	--	0	0	0	0	0	0	United States	2011	[9]
N/S	1[*1]	0	0	--	0	0	0	0	0	0	United States	2012	[9]
N/S	5[*1]	0	0	--	0	0	0	0	0	0	United States	2013	[9]

AMC- Amoxicillin- clavulanic acid; **AMP**- ampicillin; **AZM-** azithromycin; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **FOX-** cefoxitin; **NAL**- nalidixic acid; **TIO**- ceftiofur.

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

[*2] Study published in 2001 and therefore considered eligible for inclusion.

Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Derby isolates from pork meat

Note: No data was available in eligible studies

Table 3.3: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Derby isolates from pork meat

Note: resistance to macrolides and polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS	3RD GEN CEPHALOSPRORINS		CARBAPENEMS	(FLUORO)QUINOLONES			Country	Year	References
		% AMP	% CRO	% CTX	% MEM	% ENR	% CIP	% NAL			
228	11	27.3	0	--	18.2	9.1	0	54.5	China	2010-2012	[11]
208	15	86.7	6.7	--	26.7	13.3	0	40	China	2010-2012	[11]
260	20	60	0	--	15	0	0	25	China	2010-2012	[11]
400	32	18.8	3.1	--	9.4	0	0	9.4	China	2010-2012	[11]
40	1[*1]	1	--	0	--	--	--	0	Thailand	2015	[12]

AMP- ampicillin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **CTX-** cefotaxime; **ENR-** enrofloxacin; **MEM-** meropenem; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

S. Heidelberg

Table 3.4: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Heidelberg isolates from pork meat

Note: No data were available in eligible studies

Table 3.5: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Heidelberg isolates from pork meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS		1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS		(FLUORO)QUINOLONES		MACROLIDES	Country	Year	References
		% AMC	% AMP	% CEF	% FOX	% CRO	% TIO	% CIP	% NAL	% AZM			
133	1[*1]	0	0	--	0	0	0	0	0	--	Canada	2007-2008	[13]
N/S	3[*1]	0	0	--	0	0	0	0	0	--	United States	2004	[14]
N/S	4[*1]	0	0	--	0	0	0	0	0	--	United States	2006	[14]
N/S	1[*1]	0	0	--	0	0	0	0	0	0	United States	2011	[14]
N/S	2[*1]	0	1	--	0	0	0	0	0	0	United States	2013	[14]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AZM**- azithromycin; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **FOX**- cefoxitin; **NAL**- nalidixic acid; **TIO**- Cefiofur

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.6: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Heidelberg isolates from pork meat

Note: No data were available in eligible studies

Table 3.7: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Heidelberg isolates from pork meat

Note: No data were available in eligible studies

S. Infantis

Table 3.8: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Infantis isolates from pork meat

Note: No data were available for the UK in eligible studies. Resistance to macrolides and polymyxins was not explored in eligible studies

Number of food samples	Number of isolates	PENICILLINS	3ND GEN CEPHALOSPORINS		(FLUORO) QUINOLONES		Country	Year	References
		% AMP	% CAZ	% CTX	% CIP	% NAL			
170	1[*1]	0	0	0	0	0	Italy	2012	[7]

AMP- ampicillin; **CAZ**- ceftazidime; **CIP**- ciprofloxacin; **CTX**- cefotaxime; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage

Table 3.9: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Infantis isolates from pork meat

Note: Resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS		2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS		(FLUORO)QUINOLONES		MACROLIDES	Country	Year	References
		% AMC	% AMP	% FOX	% CRO	% TIO	% CIP	% NAL	% AZM			
N/S	1[*1]	0	0	0	0	0	0	0	--	United States	2005	[14]
N/S	2[*1]	0	0	0	0	0	0	0	--	United States	2006	[14]
N/S	5[*1]	0	0	0	0	0	0	0	--	United States	2007	[14]
N/S	1[*1]	0	0	0	0	0	0	0	--	United States	2008	[14]
N/S	2[*1]	1	2	1	1	1	0	0	--	United States	2009	[14]
N/S	1[*1]	0	0	0	0	0	0	0	--	United States	2010	[14]
N/S	1[*1]	0	0	0	0	0	0	0	0	United States	2011	[14]
N/S	1[*1]	0	0	0	0	0	0	0	0	United States	2012	[14]
N/S	1[*1]	0	0	0	0	0	0	0	0	United States	2013	[14]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AZM**- azithromycin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **FOX**- cefoxitin; **NAL**- nalidixic acid; **TIO**- cefiofur

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.10: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Infantis isolates from pork meat

Note: No data were available in eligible studies

Table 3.11: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Infantis isolates from pork meat

Note: resistance to macrolides and polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENEICILLINS		3RD GEN CEPHALOSPORINS		(FLUORO) QUINOLONES		Country	Year	References
		% AMP	% MEZ	% CRO	% CIP	% ENR	% NAL			
228	1[*1]	0	0	0	0	0	1	China	2010-2012	[11]
208	1[*1]	1	0	0	0	0	1	China	2010-2012	[11]

AMP- ampicillin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **ENR**- enrofloxacin; **MEZ**- mezlocillin; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

S. Typhimurium

Table 3.12: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Typhimurium isolates from pork meat

Note: resistance to macrolides was not explored in eligible studies.

Food item	Salmonella serovar	Number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)QUINOLONES			POLYMYXINS	Country	Year	References
				% AMC	% AMP	% PIP	% CEF	% CEC	% CXM	% FOX	% CAZ	% CPD	% CTX	% TIO	% CRO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% CST			
Pork meat & offal	*S.* Typhimurium DT12	1,440	1[*1]	--	0	--	--	--	--	--	--	--	--	--	--	--	--	--	0	--	0	--	**United Kingdom**	2003-2005	[1]
Pork meat & offal	*S.* Typhimurium DT120	1,440	2[*1]	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	0	--	0	--	**United Kingdom**	2003-2005	[1]
Pork meat & offal	*S.* Typhimurium DT193	1,440	1[*1]	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	0	--	**United Kingdom**	2003-2005	[1]
Pork meat & offal	*S.* Typhimurium DT208	1,440	3[*1]	--	0	--	--	--	--	--	--	--	--	--	--	--	--	--	0	--	0	--	**United Kingdom**	2003-2005	[1]
Pork meat & offal	*S.* Typhimurium U302	1,440	2[*1]	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	0	--	0	--	**United Kingdom**	2003-2005	[1]

Food item	Salmonella serovar	Number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)QUINOLONES			POLYMYXINS	Country	Year	References
				% AMC	% AMP	% PIP	% CEF	% CEC	% CXM	% FOX	% CAZ	% CPD	% CTX	% TIO	% CRO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% CST			
Pork meat & offal	*S.* Typhimurium U310	1,440	3[*1]	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	0	--	**United Kingdom**	2003-2005	[1]
Pork meat & offal	*S.* Typhimurium UT	1,440	1[*1]	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	0	--	0	--	**United Kingdom**	2003-2005	[1]
Pork meat	*S.* Typhimurium	11	11	--	27	--	--	--	--	--	--	--	--	0	--	--	--	--	--	--	0	--	Denmark	2001	[15]
Pork meat	*S.* Typhimurium	36	36	--	31	--	--	--	--	--	--	--	--	0	--	--	--	--	--	--	3	0	Denmark (domestic production)	2002	[16]
Pork meat	*S.* Typhimurium	18	18	--	72	--	--	--	--	--	--	--	--	0	--	--	--	--	--	--	11	0	Denmark (imported, country of origin unknown)	2002	[16]
Pork meat	*S.* Typhimurium	51	51	2	57	--	0	--	--	--	--	--	--	0	--	--	--	--	6	--	3	0	Denmark	2003	[17]
Pork meat	S. Typhimurium	13	13	0	54	--	8	--	--	--	--	--	--	0	--	--	--	--	0	--	0	0	Denmark (domestic production)	2004	[18]
Pork meat	*S.* Typhimurium	64	64	2	63	--	2	--	--	--	--	--	--	0	--	--	--	--	8	--	8	0	Denmark (imported, country of origin unknown)	2004	[18]
Pork meat	*S.* Typhimurium	N/S	94	0	21	--	1	--	--	--	--	0	--	0	--	--	--	--	1	--	2	0	Denmark (domestic production)	2005	[19]
Pork meat	*S.* Typhimurium	N/S	52	0	73	--	2	--	--	--	--	0	--	0	--	--	--	--	2	--	2	0	Denmark (imported, country of origin unknown)	2005	[19]
Pork meat	*S.* Typhimurium	37	37	0	73	--	0	--	--	--	--	0	--	0	--	--	--	--	5	--	5	0	Denmark (imported,	2006	[20]

Food item	Salmonella serovar	Number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)QUINOLONES			POLYMYXINS	Country	Year	References
				% AMC	% AMP	% PIP	% CEF	% CEC	% CXM	% FOX	% CAZ	% CPD	% CTX	% TIO	% CRO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% CST			
																							country of origin unknown)		
Pork meat	*S.* Typhimurium	21	21	--	48	--	0	--	--	--	--	0	--	0	--	--	--	--	0	--	0	--	Denmark (imported, country of origin unknown)	2007	[21]
Pork meat	*S.* Typhmurium DT104	250	1[*1]	1	1	0	--	0	0	0	0	--	0	0	--	0	0	0	0	0	--	--	Germany	2004	[22]
Pork meat	*S.* Typhmurium DT104	250	1[*1]	1	1	0	--	0	0	0	0	--	0	0	--	0	0	0	0	0	--	--	Germany	2004	[22]
Pork meat	*S.* Typhimurium	105	4[*1]	--	0	--	0	--	--	0	--	--	--	--	0	--	--	--	0	--	0	--	Greece	2010	[23]
Pork meat	S. Typhimurium	170	1[*1]	--	1	--	--	--	--	--	0	--	0	--	--	--	--	--	0	--	0	0	Estonia	2012	[7]
Pork meat	*S.* Typhimurium	170	9[*1]	--	1	--	--	--	--	--	0	--	0	--	--	--	--	--	0	--	0	--	Italy	2012	[7]
Pork meat	*S.* Typhimurium	197	5[*1]	--	4	--	--	--	--	--	0	--	0	-	--	--	--	--	0	--	0	--	Ireland	2007	[6]
Pork meat	*S.* Typhimurium	48	3[*1]	--	3	--	--	--	--	--	0	--	0	--	--	--	--	--	0	--	0	--	Ireland	2007	[6]
Pork meat	*S.* Typhimurium	53	1[*1]	--	0	--	--	--	--	--	0	--	0	--	--	--	--	--	0	--	0	--	Ireland	2007	[6]
Pork meat	*S.* Typhimurium	80	1[*1]	--	0	--	--	--	--	--	0	--	0	--	--	--	--	--	0	--	0	--	Ireland	2007	[6]
Pork meat	*S.* Typhimurium	90	1[*1]	--	1	--	--	--	--	--	1	--	1	--	--	--	--	--	1	--	1	--	Ireland	2007	[6]
Pork meat	*S.* Typhimurium	170	1[*1]	--	1	--	--	--	--	--	--	--	0	--	--	--	--	--	0	--	0	--	Latvia	2013	[3]
Pork meat	*S.* Typhimurium	170	11	--	45.5	--	--	--	--	--	--	--	0	--	--	--	--	--	60	--	--	--	Romania	2012	[7]

Food item	Salmonella serovar	Number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)QUINOLONES			POLYMYXINS	Country	Year	References
				% AMC	% AMP	% PIP	% CEF	% CEC	% CXM	% FOX	% CAZ	% CPD	% CTX	% TIO	% CRO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% CST			
Pork meat	*S.* Typhimurium	170	9[*1]	--	5	--	--	--	--	--	--	--	0	--	--	--	--	--	0	--	--	--	Romania	2012	[7]
Pork meat	*S.* Typhimurium	20	1[*1]	--	1	--	--	--	--	--	--	--	0	--	--	--	--	--	0	--	0	--	Sweden	2010-2011	[24]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CAZ**- ceftazidime; **CEC**- cefaclor; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CPD**- cefpodoxime; **CTX**- cefotaxime; **CXM**- cefuroxime; **ENR**- enrofloxacin; **FEP**- cefepime; **FOX**- cefoxitin; **IPM**- imipenem; **MEM**- meropenem; **NAL**- nalidixic acid; **PIP**- piperacillin; **TIO**- cefiofur

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.13: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Typhimurium isolates from pork meat

Note: resistance to polymyxins was not explored in eligible studies.

Salmonella serovar	Number of food samples	Number of isolates	PENICILLINS		1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS		(FLUORO) QUINOLONES		MACROLIDES	Country	Year	References
			% AMC	% AMP	% CEF	% FOX	% CRO	% TIO	% CIP	% NAL	% AZM			
S. Typhimurium	339	15	--	60	--	--	53	53	53	--	53	Mexico	2001-2002	[25]
S. Typhimurium	N/S	8[*1]	--	8	--	8	8	--	8	--	8	Mexico	2002-2005	[26]
S. Typhimurium	N/S	5[*1]	--	5	--	5	5	--	5	--	2	Mexico	2002-2005	[26]
S. Typhimurium	N/S	8[*1]	--	8	--	8	8	--	8	--	4	Mexico	2002-2005	[26]
S. Typhimurium	N/S	1[*1]	--	1	--	1	1	--	1	--	1	Mexico	2002-2005	[26]
S. Typhimurium DT104	50	3[*1]	0	3	0	--	0	0	0	0	--	United States	2001	[10]
S. Typhimurium DT104	50	1[*1]	0	1	0	--	0	0	0	0	--	United States	2001	[10]
S. Typhimurium	N/S	2[*1]	0	1	--	0	0	0	0	0	--	United States	2002	[14]
S. Typhimurium	N/S	1[*1]	0	1	--	0	0	0	0	0	--	United States	2003	[14]
S. Typhimurium	N/S	2[*1]	0	1	--	0	0	0	0	0	--	United States	2004	[14]
S. Typhimurium	N/S	2[*1]	0	2	--	0	0	0	0	0	--	United States	2005	[14]
S. Typhimurium	N/S	2[*1]	0	2	--	0	0	0	0	0	--	United States	2006	[14]
S. Typhimurium	N/S	3[*1]	0	0	--	0	0	0	0	0	--	United States	2007	[14]
S. Typhimurium	N/S	3[*1]	0	0	--	0	0	0	0	0	--	United States	2008	[14]
S. Typhimurium	N/S	1[*1]	0	1	--	0	0	0	0	0	--	United States	2009	[14]
S. Typhimurium	N/S	5[*1]	0	1	--	0	0	0	0	0	--	United States	2010	[14]
S. Typhimurium	N/S	7[*1]	--	2	--	0	0	0	0	0	0	United States	2011	[14]
S. Typhimurium	N/S	6[*1]	0	1	--	0	0	0	0	0	0	United States	2012	[14]
S. Typhimurium	N/S	4[*1]	0	3	--	0	0	0	0	0	0	United States	2013	[14]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AZM**- azithromycin; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **FOX**- cefoxitin; **NAL**- nalidixic acid; **TIO**- cefiofur

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.14: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Typhimurium isolates from pork meat

Note: No data were available in eligible studies

Table 3.15: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *S.* Typhimurium isolates from pork meat

Note: resistance to macrolides and polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS		(FLUORO)QUINOLONES			Country	Year	References
		% AMC	% AMP	% AMX	% MEZ	% CEF	% CRO	% CTX	% CIP	% ENR	% NAL			
208	2[*1]	--	2	--	1	--	0	--	0	0	1	China	2010-2012	[11]
228	2[*1]	--	2	--	1	--	0	--	0	0	1	China	2010-2012	[11]
400	2[*1]	--	0	--	0	--	0	--	0	0	0	China	2010-2012	[11]
260	11	--	63.6	--	0	--	0	--	0	0	54.5	China	2010-2012	[11]
41	2[*1]	--	2	--	--	0	--	--	0	--	0	Thailand	2010	[27]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin;; **CEF**- cephalothin;; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **ENR**- enrofloxacin;; **MEZ**- mezlocillin **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage

***Salmonella* spp.**

Table 3.16: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *Salmonella* spp. isolates from pork meat

Note: No data were available for the UK in eligible studies. Resistance to macrolides was not explored in eligible studies.

Food item	Number of food samples	Number of isolates	PENICILLINS		1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS				4RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLUORO) QUINOLONES			POLYMYXINS	Country	Year	References
			% AMC	% AMP	% CEF	% CFZ	% FOX	% CAZ	% CPD	% CRO	% CTX	% FEP	% IPM	% CIP	% ENR	% NAL	% CST			
Pork meat	42	2[*1]	--	0	--	--	--	--	--	--	0	--	--	0	--	1	--	Austria	2004	[28]
Pork meat	96	5[*1]	--	--	--	--	1	--	--	--	--	--	--	--	--	0	--	Austria	2006	[29]
Pork meat	241	128	--	27	--	--	--	--	--	--	--	--	--	0	--	4	--	Belgium	2004	[28]
Mince meat	437	128	--	27	--	--	--	--	--	--	--	--	--	0	--	4	--	Belgium	2004	[28]
Pork meat	49	49	--	20	--	--	--	--	--	--	--	--	--	0	--	0	0	Denmark	1999	[29]
Pork meat	225	2[*1]	--	2	--	--	--	--	--	--	0	--	--	0	0	0	--	Estonia	2004	[28]
Pork meat	347	2[*1]	--	--	--	--	1	--	--	--	--	--	--	--	--	0	--	Estonia	2006	[29]
Pork meat	624	772	--	37	--	--	--	--	--	--	0.5	--	--	0.2	0.7	6	--	Italy	2004	[28]
Pork meat	772	342	--	37	--	--	--	--	--	--	0.5	--	--	0.2	0.7	6	--	Italy	2004	[28]
Pork meat	170	127	--	31	--	--	--	--	--	--	0.8	--	--	3.1	--	2.4	--	Italy	2013	[3]
Pork meat	46	1[*1]	--	0	--	--	--	--	--	--	--	--	--	0	--	0	--	Lithuania	2004	[28]
Pork meat	333	7[*1]	--	0	--	--	--	--	--	--	--	--	--	0	--	0	--	Netherlands	2004	[28]
Pork meat	N/S	7[*1]	--	1	--	--	0	0	--	0	--	0	0	0	--	1	--	Poland	2008-2012	[30]
Pork meat	N/S	242	--	--	--	--	--	--	--	--	1.2	--	--	0	--	--	--	Portugal	2009-2011	[31]
Pork meat	208	48	--	38	--	--	--	15	--	--	0	--	--	--	--	25	--	Romania	2011	[32]
Pork meat	170	93	--	43	--	--	--	--	--	--	3.2	--	--	16	--	12	--	Romania	2013	[3]
Pork meat	293	1[*1]	--	0	--	--	--	--	--	--	--	--	--	0	--	0	--	Spain	2004	[28]
Pork meat	197	22	--	32	--	4.6	--	--	--	--	0	--	--	0	--	0	--	Spain	2005	[33]
Pork meat	196	9[^1]	0	1	0	--	--	--	--	0	--	--	--	0	--	0	--	Spain	2006-2012	[34]
Pork meat	1,270	57	0	30	0	--	--	--	--	1.8	--	--	--	0	--	12	--	Spain	2006-2012	[34]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CAZ**- ceftazidime; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CFZ**- cefazolin; **CPD** cefpodoxime; **CRO**- ceftriaxone; **CTX**- cefotaxime; **ENR**- enrofloxacin; **FEP**- cefepime; **FOX**- cefoxitin; **IMP**- imipenem; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.17: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *Salmonella* spp. isolates from pork meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS		2ND GEN CEPHALOSPORINS		3RD GEN CEPHALOSPORINS	(FLUORO)QUINOLONES		MACROLIDES	Country	Year	References
		% AMC	% AMP	% FOX	% CRO	% TIO	% CIP	% NAL	% AZM			
N /S	11	2	21	2	0	2	0	0	--	Canada	2002	[35]
2,612	36	3	28	3	3	3	0	0	--	Canada	2003-2008	[36]
244	4[*1]	0	0	0	0	0	0	0	--	Canada (British Columbia)	2003-2008	[36]
978	14	0	42.9	0	0	0	0	0	--	Canada (Ontario)	2003-2008	[36]
840	9[*1]	1	4	1	1	1	0	0	--	Canada (Quebec)	2003-2008	[36]
86	2[*1]	0	0	0	0	0	0	0	--	Canada (Maritimes region)	2003-2008	[36]
464	7[*1]	0	0	0	0	0	0	0	--	Canada (Saskatchewan)	2003-2008	[36]
81	14	--	85.7	--	--	0	--	0	14.3	Mexico	2007-2008	[37]
N/S	10	20	40	20	20	20	0	0	--	United States	2002	[14]
N/S	5[*1]	1	2	1	1	1	0	0	--	United States	2003	[14]
N/S	11	0	9.1	0	0	0	0	0	--	United States	2004	[14]
N/S	9[*1]	0	2	0	0	0	0	0	--	United States	2005	[14]
N/S	8[*1]	0	2	0	0	0	0	0	--	United States	2006	[14]
N/S	18	0	5.6	0	0	0	0	0	--	United States	2007	[14]
N/S	23	0	13	0	0	0	0	0	--	United States	2008	[14]
N/S	8[*1]	2	3	2	2	2	0	0	--	United States	2009	[14]
N/S	20	0	15	0	0	0	0	0	--	United States	2010	[14]

Number of food samples	Number of isolates	PENICILLINS		2ND GEN CEPHALOSPORINS		3RD GEN CEPHALOSPORINS	(FLUORO)QUINOLONES		MACROLIDES	Country	Year	References
		% AMC	% AMP	% FOX	% CRO	% TIO	% CIP	% NAL	% AZM			
N/S	28	3.	46.4	10.7	7.1	7.1	0	0	0	United States	2011	[14]
N/S	12	0	16.7	0	0	0	0	0	0	United States	2012	[14]
N/S	24	0	25	0	0	0	0	0	0	United States	2013	[14]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AZM**- azithromycin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **FOX**- cefoxitin; **NAL**- nalidixic acid; **TIO**- cefiofur
[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.18: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *Salmonella* spp. isolates from pork meat

Note: No data were available in eligible studies

Table 3.19: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *Salmonella* spp. isolates from pork meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS					1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS				CARBAPENEMS	(FLUORO)QUINOLONES			MACROLIDES	Country	Year	References
		% AMC	% AMP	% AMX	% PEN	% PIP	% CEF	% CFZ	% FOX	% CAZ	% CFP	% CRO	% CTX	% IPM	% CIP	% ENR	% NAL	% ERY			
45	12	0	16.7	16.7	16.7	8.3	0	0	--	8.3	0	0	--	--	0	--	50	--	China	2005	[38]
91	38	68.4	47.4	--	--	--	--	--	13.2	--	7.9	0	--	--	7.9	--	76	--	China	2007-2008	[39]
110	78		23.1	--	--	--	--	1.3	--	--	--	1.3	1.3	--	2.6	--	34.6	--	China	2013-2014	[40]
192	13	30.8	30.8	--	--	--	--	--	0	--	--	7.7	--	--	0	--	38.5	--	China	2013-2014	[41]
100	1[*1]	--	0	--	--	--	--	--	--	--	--	--	0	0	0	--	--	0	Japan	2004-2006	[42]
27	35	11.4	21	--	--	--	--	--	--	--	--	--	5.7	--	0	--	5.7	--	Laos	2011	[43]
N/S	64	--	85.9	--	--	--	--	--	--	--	20.3	--	--	--	0	--	--	--	Thailand	2010-2013	[44]
N/S	48	--	6.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Vietnam	1999-2001	[45]
50	32	--	--	25	--	--	--	--	--	--	--	--	--	--	--	12.5	21.9	--	Vietnam	2004	[46]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **CAZ**- ceftazidime; **CEF**- cephalothin; **CFP**- cefoperazone; **CFZ**- cephazolin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **CTX**- cefotaxime; **ENR**- enrofloxacin; **ERY**- erythromycin; **FOX**- cefoxitin; **IPM-** imipenem; **NAL**- nalidixic acid; **PEN**- penicillin (generic); **PIP**- piperacillin

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Other *Salmonella* strains (excluding *S.* Derby, *S.* Typhimurium, *S.* Heidelberg, *S.* Infantis and *Salmonella* spp.)

Table 3.20: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *Salmonella* isolates (excluding *S.* Derby, *S.* Typhimurium, *S.* Heidelberg, *S.* Infantis and *Salmonella* spp.) from pork meat

Note: resistance to macrolides was not explored in eligible studies

Salmonella Serovar	Number of food samples	Number of isolates	PENICILLINS	1ST GEN CEPHALOSPORINS	2ND GEN. CEPHALOSPORINS	3RD GEN CEPHALOSPORINS	(FLUORO) QUINOLONES	POLYMYXINS	Country	Year	References

			% AMP	% CEF	% FOX	% CAZ	% CPD	% CTX	% TIO	% CRO	% CIP	% NAL	% CST			
S. Agona	1,440	1[*1]	0	--	--	--	--	--	--	--	0	0	--	**United Kingdom**	2003-2005	[1]
S. Arizonae	1,440	1[*1]	0	--	--	--	--	--	--	--	0	0	--	**United Kingdom**	2003-2005	[1]
S. Choleraesuis	1,440	1[*1]	0	--	--	--	--	--	--	--	0	0	--	**United Kingdom**	2003-2005	[1]
S. Kedougou	1,440	1[*1]	0	--	--	--	--	--	--	--	0	0	--	**United Kingdom**	2003-2005	[1]
S. Newport	1,440	3[*1]	0	--	--	--	--	--	--	--	0	0	--	**United Kingdom**	2003-2005	[1]
S. Stanleyville	1,440	1[*1]	0	--	--	--	--	--	--	--	0	0	--	**United Kingdom**	2003-2005	[1]
Salmonella (untyped)	1,440	8[*1]	3	--	--	--	--	--	--	--	0	0	--	**United Kingdom**	2003-2005	[1]
S. Cerro	1,693	3[*1]	0	--	--	--	--	--	--	--	--	--	--	**United Kingdom**	2007	[2]
C. Virchow PT26	1,693	1[*1]	0	--	--	--	--	--	--	--	--	--	--	**United Kingdom**	2007	[2]
S. Schwarzengrund	4	4[*1]	0	--	--	--	--	--	--	--	0	0	--	Denmark	1995-2004	[47]
S. Rissen	19	9[*1]	2	0	--	--	0	--	0	--	0	0	--	Denmark	1996-2005	[48]
S. Enteritidis	170	1[*1]	0	--	--	0	--	0	--	--	0	0	--	Czech Republic	2012	[7]
S. enterica serovar 1,4, 5,12:i:-	170	2[*1]	2	--	--	0	--	0	--	--	0	0	--	Czech Republic	2012	[7]
S. Agona	170	1[*1]	0	--	--	0	--	0	--	--	0	--	0	Estonia	2012	[7]
S. Bareilly	170	1[*1]	0	--	--	0	--	0	--	--	0	0	0	Estonia	2012	[7]
S. Mbandaka	170	1[*1]	1	--	--	0	--	0	--	--	0	0	0	Estonia	2013	[3]
S. enterica serovar 4,5,12:i:	N/S	30	10	--	--	--	--	--	--	--	--	--	--	Germany	2006-2007	[49]
S. Saintpaul	105	5[*1]	0	0	0	--	--	--	--	0	0	0	--	Greece	2010	[23]
S. Fryis	105	2[*1]	0	0	0	--	--	--	--	0	0	0	--	Greece	2010	[23]
S. Rissen	53	1[*1]	0	--	--	0	--	0	--		0	0	--	Ireland	2007	[6]
S. enterica serovar 4,12:i:-	170	3[*1]	1	--	--	0	--	0	--		0	0	--	Italy	2012	[7]
S. enterica serovar 4,5,12:i:-	170	2[*1]	1	--	--	0	--	0	--		0	0	--	Italy	2012	[7]
S. Kapemba	170	1[*1]	0	--	--	0	--	0	--		0	0	--	Italy	2012	[7]
S. Livingstone	170	1[*1]	0	--	--	0	--	0	--		0	0	--	Italy	2012	[7]
S. London	170	1[*1]	0	--	--	0	--	0	--		0	0	--	Italy	2012	[7]
S. Muenchen	170	1[*1]	0	--	--	0	--	0	--		0	0	--	Italy	2012	[7]
S. Panama	170	2[*1]	1	--	--	0	--	0	--		0	0	--	Italy	2012	[7]
S. Rissen	170	2[*1]	0	--	--	0	--	0	--		0	0	--	Italy	2012	[7]
S. Bovismorbificans	170	1[*1]	1	--	--	--	--	0	--		0	0	--	Latvia	2013	[3]

Salmonella Serovar	Number of food samples	Number of isolates	PENICILLINS	1ST GEN CEPHALOSPORINS	2ND GEN. CEPHALOSPORINS	3RD GEN CEPHALOSPORINS					(FLUORO) QUINOLONES		POLYMYXINS	Country	Year	References
			% AMP	% CEF	% FOX	% CAZ	% CPD	% CTX	% TIO	% CRO	% CIP	% NAL	% CST			
S. Enteritidis	170	1[*1]	0	--	--	--	--	0	--		0	0	--	Romania	2012	[7]
S. Bovismorbificans	170	1[*1]	0	--	--	--	--	0	--		0	--	--	Romania	2012	[7]
S. Bredeney	170	11	9.1	--	--	--	--	0	--		0	--	--	Romania	2012	[7]
S. Gloucester	170	5[*1]	4	--	--	--	--	0	--		0	--	--	Romania	2012	[7]
S. Kortrijk	170	5[*1]	0	--	--	--	--	4	--		4	--	--	Romania	2012	[7]
S. Rissen	170	2[*1]	0	--	--	--	--	0	--	--	1	0	--	Romania	2012	[7]
S. Ruzizi	170	5[*1]	5	--	--	--	--	0	--	--	0	0	--	Romania	2012	[7]
S. enterica serovar subsp.I	44	1[*1]	1	--	--	--	--	0	--	--	0	0	--	Sweden	2010-2011	[24]

AMP- ampicillin; **CAZ**- ceftazidime; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CPD**- cefpodoxime; **CST-** colistin; **CTX**- cefotaxime; **FOX-** cefoxitin; **NAL**- nalidixic acid; **TIO**- Cefiofur

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.21: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *Salmonella* isolates (excluding *S.* Derby, *S*. Typhimurium, *S*. Heidelberg, *S.* Infantis and *Salmonella* spp.) from pork meat

Salmonella Serovar	Number of food samples	Number of isolates	PENICILLINS	1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS	(FLUORO)QUINOLONES	MACROLIDES	POLYMYXINS	Country	Year	References

			% AMC	% AMP	% PEN	% CEF	% FOX	% CRO	% CTX	% TIO	% CIP	% NAL	% AZM	% ERY	% TYL	% CST			
S. Anatum	90	6[*1]		0	1			0	0		1	0		1	1	0	Argentina	2005-2010	[50]
S. Give	133	1[*1]	0	0	--	--	0	0	--	0	0	0	--	--	--	--	Canada	2007-2008	[13]
S. Johannesburg	133	1[*1]	0	0	--	--	0	0	--	0	0	0	--	--	--	--	Canada	2007-2008	[13]
S. Agona	339	14	0	0	--	0	0	--	--	--	--	--	0	--	--	--	Mexico	2001-2002	[25]
S. Enteritidis	339	1[*1]	0	0	--	0	0	--	--	--	--	--	1	--	--	--	Mexico	2001-2002	[25]
S. Saintpaul	N/S	7[*1]	0	1	--	--	0	0	--	0	0	0	--	--	--	--	United States	1988 - 2009	[51]
S. Agona	50	1[*1]	0	0	--	0	--	0	--	0	0	0	--	--	--	--	United States	2001	[10]
S. Senftenberg	50	1[*1]	0	0	--	0	--	0	--	0	0	0	--	--	--	--	United States	2001	[10]
S. Djugo	50	1[*1]	0	0	--	0	--	0	--	0	0	0	--	--	--	--	United States	2001	[10]
S. Chomedy	50	1[*1]	0	0	--	0	--	0	--	0	0	0	--	--	--	--	United States	2001	[10]
S. Newport	N/S	2[*1]	1	1	--	--	1	1	--	1	0	0	--	--	--	--	United States	2002	[14]
S. Johannesburg	N/S	2[*1]	0	0	--	--	0	0	--	0	0	0	--	--	--	--	United States	2003	[14]
S. Newport	N/S	1[*1]	1	1	--	--	1	1	--	1	0	0	--	--	--	--	United States	2003	[14]
S. Anatum	N/S	2[*1]	0	0	--	--	0	0	--	0	0	0	--	--	--	--	United States	2005	[14]
S. Montevideo	N/S	1[*1]	0	0	--	--	0	0	--	0	0	0	--	--	--	--	United States	2006	[14]
S. Johannesburg	N/S	2[*1]	0	0	--	--	0	0	--	0	0	0	--	--	--	--	United States	2008	[14]
S. Anatum	N/S	1[*1]	0	1	--	--	0	0	--	0	0	0	--	--	--	--	United States	2010	[14]
S. Montevideo	N/S	1[*1]	0	0	--	--	0	0	--	0	0	0	--	--	--	--	United States	2010	[14]
S. Kentucky	N/S	1[*1]	0	0	--	--	0	0	--	0	0	0	0	--	--	--	United States	2012	[14]
S. enterica serovar I 4,[5], 12:i	N/S	2[*1]	0	2	--	--	0	0	--	0	0	0	0	--	--	--	United States	2013	[14]
S. Johannesburg	N/S	3[*1]	0	0	--	--	0	0	--	0	0	0	0	--	--	--	United States	2013	[14]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AZM**- azithromycin; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **CTX-** cefotaxime; **ERY-** erythromyxin; **FOX**- cefoxitin; **NAL**- nalidixic acid; **PEN-** penicillin; **TYL-** tylosin; **TIO**- Cefiofur

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.22: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *Salmonella* isolates (excluding *S.* Derby, *S*. Typhimurium, *S*. Heidelberg, *S.* Infantis and *Salmonella* spp.) from pork meat

Note: No data were available in eligible studies

Table 3.23: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *Salmonella* isolates (excluding *S.* Derby, *S*. Typhimurium, *S*. Heidelberg, *S.* Infantis and *Salmonella* spp.) from pork meat

Note: resistance to macrolides and polymyxins was not explored.

Salmonella Serovar	Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS		3RD GEN CEPHALOSPORINS			4TH GEN CEPHALOSPORINS	(FLUORO)QUINOLONES			Country	Year	References
			% AMP	% AMC	% AMX	% MEZ	% CEF	% CRO	% CTX	% CAZ	% CFS	% FEP	% CIP	% ENR	% NAL			
S. Choleraesuis	92	1[*1]	1	--	--	--	--	--	--	--	--	--	--	--	--	China	2007-2008	[52]
S. London	92	1[*1]	--	--	--	--	--	--	--	--	1	--	--	--	--	China	2007-2008	[52]
S. Agona	208	6[*1]	1	--	--	0	--	0	--	--	--	--	0	0	0	China	2010-2012	[11]
S. Meleagridis	208	8[*1]	1	--	--	0	--	0	--	--	--	--	0	0	6	China	2010-2012	[11]
S. Give	208	1[*1]	1	--	--	0	--	0	--	--	--	--	0	0	1	China	2010-2012	[11]
S. Anatum	228	6[*1]	2	--	--	2.	--	0	--	--	--	--	0	0	3	China	2010-2012	[11]
S. London	228	7[*1]	0	--	--	0	--	0	--	--	--	--	0	0	0	China	2010-2012	[11]
S. Give	228	1[*1]	0	--	--	0	--	0	--	--	--	--	0	0	0	China	2010-2012	[11]
S. Limete	228	1[*1]	0	--	--	0	--	0	--	--	--	--	0	0	1	China	2010-2012	[11]
S. Muenster	228	1[*1]	1	--	--	0	--	0	--	--	--	--	0	0	0	China	2010-2012	[11]
S. Infantis	400	4[*1]	2	--	--	2	--	0	--	--	--	--	0	0	3	China	2010-2012	[11]
S. Virchow	400	1[*1]	0	--	--	0	--	0	--	--	--	--	0	0	1	China	2010-2012	[11]
S. Anatum	400	8[*1]	0	--	--	1	--	0	--	--	--	--	0	0	1	China	2010-2012	[11]

Salmonella Serovar	Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS		3RD GEN CEPHALOSPORINS			4TH GEN CEPHALOSPORINS	(FLUORO)QUINOLONES			Country	Year	References
			% AMP	% AMC	% AMX	% MEZ	% CEF	% CRO	% CTX	% CAZ	% CFS	% FEP	% CIP	% ENR	% NAL			
S. Meleagridis	400	4[*1]	1	--	--	0	--	0	--	--	--	--	0	0	1	China	2010-2012	[11]
S. Schwarzengrund	400	1[*1]	0	--	--	0	--	0	--	--	--	--	0	0	0	China	2010-2012	[11]
S. London	400	1[*1]	0	--	--	0	--	0	--	--	--	--	0	0	0	China	2010-2012	[11]
S. Muenster	400	2[*1]	0	--	--	0	--	0	--	--	--	--	0	0	0	China	2010-2012	[11]
S. Newport	260	5[*1]	2	--	--	0	--	0	--	--	--	--	0	0	1	China	2010-2012	[11]
S. Meleagridis	260	3[*1]	2	--	--	0	--	0	--	--	--	--	0	0	2	China	2010-2012	[11]
S. London	260	3[*1]	1	--	--		--	0	--	--	--	--	0	0	0	China	2010-2012	[11]
S. Chester	260	3[*1]	0	--	--	0	--	0	--	--	--	--	0	0	0	China	2010-2012	[11]
S. Stanley	N/S	1[*1]	1	1	--	--	--	--	0	0	--	0	0	--	--	China	2006-2012	[53]
S. Albany	40	1[*1]	1	--	--	--	--	--	0	--	--	--	--	--	1	Thailand	2015	[12]
S. Braenderup	40	1[*1]	0	--	--	--	--	--	0	--	--	--	--	--	1	Thailand	2015	[12]
S. Bareilly	40	1[*1]	1	--	--	--	--	--	0	--	--	--	--	--	1	Thailand	2015	[12]
S. Stanley	40	3[*1]	--	--	0	--	--	--	--	--	--	--	0	--	--	Thailand	2003	[54]
S. Rissen	40	16	--	--	2	--	--	--	--	--	--	--	0	--	--	Thailand	2003	[54]
S. Panama	40	1[*1]	--	--	1	--	--	--	--	--	--	--	0	--	--	Thailand	2003	[54]
S. Panama	40	8[*1]	8	--	--	--	--	--	0	--	--	--	--	--	0	Thailand	2015	[12]
S. Anatum	40	1[*1]	--	--	0	--	--	--	--	--	--	--	0	--	--	Thailand	2003	[54]
S. Lexington	40	3[*1]	--	--	0	--	--	--	--	--	--	--	0	--	--	Thailand	2003	[54]
S. Weltevreden	40	1[*1]	--	--	0	--	--	--	--	--	--	--	0	--	--	Thailand	2003	[54]
S. Worthington	40	1[*1]	--	--	1	--	--	--	--	--	--	--	0	--	--	Thailand	2003	[54]
S. Seftenberg	17	1[*1]	0	--	--	--	--	--	--	--	--	--	0	--	0	Thailand	2006-2006	[54]
S. Stanley	17	2[*1]	2	--	--	--	--	--	--	--	--	--	0	--	2	Thailand	2006-2006	[54]

Salmonella Serovar	Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS		3RD GEN CEPHALOSPORINS			4TH GEN CEPHALOSPORINS	(FLUORO)QUINOLONES			Country	Year	References
			% AMP	% AMC	% AMX	% MEZ	% CEF	% CRO	% CTX	% CAZ	% CFS	% FEP	% CIP	% ENR	% NAL			
S. Stanley	40	5[*1]	5	--	--	--	--	--	0	--	--	--	--	--	2	Thailand	2015	[12]
S. Rissen	41	13	7.7	--	--	--	7.7	--	--	--	--	--	0	--	0	Thailand	2010	[27]
S. Rissen	40	6[*1]	6	--	--	--	--	--	1	--	--	--	--	--	1	Thailand	2015	[12]
S. Anatum	41	3[*1]	1	--	--	--	1	--	--	--	--	--	0	--	0	Thailand	2010	[27]
S. Anatum	40	7[*1]	7	--	--	--	--	--	0	--	--	--	--	--	3	Thailand	2015	[12]
S. Weltevreden	41	12	75	--	--	--	42	--	--	--	--	--	0	--	0	Thailand	2010	[27]
S. Give	41	4[*1]	3	--	--	--	0	--	--	--	--	--	0	--	0	Thailand	2010	[27]
S. Kentucky	41	1[*1]	1	--	--	--	0	--	--	--	--	--	0	--	0	Thailand	2010	[27]
S. Bredeney	41	9[*1]	6	--	--	--	6	--	--	--	--	--	0	--	0	Thailand	2010	[27]
S. Schwarzengrund	40	1[*1]	1	--	--	--	--	--	0	--	--	--	--	--	1	Thailand	2015	[12]
4,5,12:i-	40	2[*1]	2	--	--	--	--	--	0	--	--	--	--	--	1	Thailand	2015	[12]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **CAZ-** ceftazidime; **CEF**- cephalothin; **CFS**- cefsulodin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **CTX**- cefotaxime; **ENR**- enrofloxacin; **MEZ**- mezlocillin; **NAL**- nalidixic acid.

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

MDR phenotypes in *S.* Derby

Table 3.24: UK & Europe- MDR phenotypes observed in *S.* Derby isolates from pork meat

Food Item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Pork meat & offal	8	1	STR, SUL, TET, TMP	**United Kingdom**	2003-2005	[1]
Pork meat	1	1	CAZ, CTX	Czech Republic	2013	[3]
Pork meat	27	20	SXT, TET, TMP (n= 2); STR, SXT, TET, TMP (n= 17); AMP, STR, SXT, TET, TMP (n= 1)	France	2006-2007	[4]
Pork meat	12	1	SMZ, SPT, STR, TET	Germany	2006-2007	[5]
Pork meat	1	1	STR, SXT, TET	Ireland	2007	[6]
Pork meat	5	N/S	CAZ, CTX	Latvia	2013	[3]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.25: North, Central & South America- MDR phenotypes observed in *S.* Derby isolates from pork meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
2	1	AMC, AMP, CEF, FOX, TIO, STR, SXT, TET	Canada	2002	[35]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.26: Africa- MDR phenotypes observed in *S.* Derby isolates from pork meat

Note: no data were available in eligible studies

Table 3.27: Asia- MDR phenotypes observed in *S.* Derby isolates from pork meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
2	2	AMP, CHL, SXT, TET, TMP; AMP, CHL, KAN, NAL, STR, TET	China	1999-2000	[55]
1	1	CFP, CHL, PIP, STR, SXT, TET, TZP	China	2007-2008	[52]
15	7	AMP, CFZ, CHL, CRO, ENR, MEZ, NAL, STR, SXT, TET (n= 1); AMP, NAL, TET (n= 3); AMP, CFZ, NAL, TET (n= 1); AMP, STR, SXT, TET (n= 1); AMP, MEZ, NAL, TET (n= 1)	China	2010-2012	[11]
11	3	AMP, CHL, GEN, STR, SXT, TET (n= 1); AMP, CHL, ENR, MEZ, NAL, STR, SXT (n= 1); AMP, CHL, GEN, MEZ, NAL, STR, SXT (n= 1)	China	2010-2012	[11]
32	3	AMP, CHL, MEZ, NAL, SXT, TET (n= 1); AMP, MEZ, SXT, TET (n= 1); AMP, CHL, TET, STR, SXT (n= 1)	China	2010-2012	[11]
20	7	AMP, CHL, NAL, TET (n= 1); AMP, CHL, MEZ, NAL, OFX, STR, SXT, TET (n= 2); AMP, CHL, TET (n= 1); AMP, CHL, CIP, GEN, KAN, NAL, OFX, SXT, TET (n= 1); AMP, STR, TET (n= 1); AMP, CHL, GEN, NAL, STR, SXT, TET (n= 1)	China	2010-2012	[11]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

MDR phenotypes in *S.* Heidelberg

Table 3.28: UK an Europe- MDR phenotypes observed in *S.* Heidelberg isolates from pork meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
1	1	KAN, STR, SXT, TET	Unitied States	2001	[10]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.29: North, Central & South America- MDR phenotypes observed in *S.* Heidelberg isolates from pork meat

Note: No data were available in eligible studies

Table 3.30: Africa- MDR phenotypes observed in *S.* Heidelberg isolates from pork meat

Note: No data were available in eligible studies

Table 3.31: Asia- MDR phenotypes observed in *S.* Heidelberg isolates from pork meat

Note: No data were available in eligible studies

MDR phenotypes in *S.* Infantis

Table 3.32: UK & Europe- MDR phenotypes observed in *S.* Infantis isolates from pork meat

Note: No data were available in eligible studies

Table 3.33: North, Central & South America- MDR phenotypes observed in *S.* Infantis isolates from pork meat

Note: No data were available in eligible studies

Table 3.34: Africa- MDR phenotypes observed in *S.* Infantis isolates from pork meat

Note: No data were available in eligible studies

Table 3.35: Asia- MDR phenotypes observed in *S.* Infantis isolates from pork meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
4	3	NAL, SXT, TET (n= 1); AMP, CHL, MEZ, NAL, SXT, TET (n= 1); AMP, CHL, MEZ, NAL, SXT (n= 1)	China	2010-2012	[11]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

MDR in *S.* Typhimurium

Table 3.36: UK & Europe- MDR phenotypes observed in *S.* Typhimurium isolates from pork meat

Salmonella serovar	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
S. Typhimurium DT104	9	9	AMP, CHL, STR, SUL, TET (n= 6); AMP, CHL, NAL, STR, SUL, TET, (n= 3)	**United Kingdom**	2003-2005	[1]
S. Typhimurium DT104b	4	4	AMP, CHL, STR, SUL, TET, TMP (n= 2); AMP, STR, SUL, TET, TMP (N= 1); STR, SUL, TET (n= 1)	**United Kingdom**	2003-2005	[1]
S. Typhimurium DT120	2	1	AMP, NAL, STR, SUL, TET, TMP	**United Kingdom**	2003-2005	[1]
S. Typhimurium DT193	1	1	AMP, KAN, NEO, STR, SUL, TET, TMP	**United Kingdom**	2003-2005	[1]
S. Typhimurium U302	2	2	AMP, CHL, STR, SUL, TET, TMP	**United Kingdom**	2003-2005	[1]
S. Typhimurium U310	3	1	AMP, CHL, CIP, KAN, TET	**United Kingdom**	2003-2005	[1]
S. Typhimurium	1	1	AMP, CHL, STR, SUL, TET, TMP	**United Kingdom**	2003-2005	[1]
S. Typhimurium DT120	1	1	AMP, STR, SXT, TET	**United Kingdom**	2006	[2]
S. Typhimurium U311	2	2	AMP, CHL, STR, SXT, SPT, TET (n= 2)	**United Kingdom**	2006	[2]
S. Typhimuirium DT109	1	1	STR, SXT, TET	**United Kingdom**	2007	[2]
S. Typhimurium DT104	1	1	AMP, AMC, PIP, STR, SPT, DOX, FFC, CHL	Germany	2004	[22]
S. Typhimurium DT104	2	2	AMP, AMC, PIP, STR, SPT, DOX, FFC, CHL	Germany	2004	[22]
S. Typhimurium	5	5	STR, TET, TMP (n= 1); AMP, CHL, STR, SXT, TET, TMP, KAN (n= 2); AMP, CHL, STR, SXT, TET (n= 2)	Ireland	2007	[6]
S. Typhimurium	3	3	AMP, CHL, KAN, SXT, TET, TMP, (n=1); CHL, STR, SXT, TET, TMP (n= 1); CHL, STR, SXT, TET, TMP (n= 1)	Ireland	2007	[6]
S. Typhimurium	1	1	ESBL	Latvia	2013	[3]
S. Typhimurium	1	1	AMP, SXT, TET, TMP	Sweden	2010-2011	[24]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

ESBL- Extended-Spectrum Beta-Lactamase

Table 3.37: North, Central & South America- MDR phenotypes observed in *S.* Typhimurium isolates from pork meat

Salmonella serovar	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
S. Typhimurim	1	1	AMP, CHL, STR, SXT, TET (ACSuT pattern)	Canada	2002	[35]
S. Typhimurium DT101	1	1	AMP, CHL, STR, SXT, TET (ACSSuT pattern)	Canada	2002	[35]
S. Typhimurim DT104	6	4	AMP, CHL, STR, SXT, TET (ACSSuT pattern);	Canada	2002	[35]
S. Typhimurim	8	8	AMP, CRO, CHL, FOX, STR, SXT, TET, TIO, TMP (n= 4); AMP, CRO, CHL, FOX, STR, SXT, TET, TIO, TMP, NAL (n= 3); AMP, CRO, CHL, FOX, GEN, KAN, NAL, STR, SXT, TET, TMP, TIO (n= 1)	Mexico	2002-2005	[26]
S. Typhimurim	1	1	AMP, FOX, CRO, CHL, NAL, STR, SXT, TET, TIO	Mexico	2002-2005	[26]
S. Typhimurim	2	2	AMP, CHL, STR, SXT, TET; AMP, CHL, FFC, STR, SXT, TET	United States	1999-2000	[55]
S. Typhimurim DT104	3	1	AMP, CHL, FFC, STR, SXT,TET	United States	2001	[10]
S. Typhimurim DT104	1	1	AMP, CHL, FFC, STR, SXT,TET	United States	2001	[10]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.38: Africa- MDR phenotypes observed in *S.* Typhimurium isolates from pork meat

Note: No data were available in eligible studies

Table 3.39: Asia- MDR phenotypes observed in *S.* Typhimurium isolates from pork meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
6	3	AMP, GEN, KAN, NAL, STR, SXT, TET (n= 1); AMP, CHL, MEZ, SXT, TET (n= 1); CHL, GEN, STR, TET (n= 1)	China	2010-2012	[11]
11	7	AMP, CHL, KAN, NAL, SXT, TET (n= 1); AMP, CHL, KAN, NAL, SXT, TET (n= 1); AMP, CHL, GEN, KAN, STR, SXT, TET (n= 1); AMP, CHL, STR, SXT, TET (n= 1); AMP, GEN, KAN, NAL, STR, SXT, TET (n= 1); AMP, GEN, KAN, SXT, TET (n= 1); AMP, CHL, GEN, KAN, NAL, SXT (n= 1)	China	2010-2012	[11]
2	1	AMP, STR, TET	Thailand	2010	[27]
1	1	AMP, AMX, GEN, KAN, STR, SUL, TET, TMP	Vietnam	2004	[56]
32	1	AMP, AMX, GEN, KAN SUL, STR , TET, TMP (n= 1)	Vietnam	2004	[46]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Ceflofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

MDR phenotypes in *Salmonella* spp.

Table 3.40: UK & Europe- MDR phenotypes observed in *Salmonella* spp. isolates from pork meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
9	1	AMP, CHL, TET	**United Kingdom**	2006-2012	[34]
57	15	AMP, CHL, TET (n= 4); AMP, CHL, NAL, TET (n= 1); CHL, SXT, TET (n= 1); AMP, SXT, TET (n= 2); AMP, CHL, SXT, TET (n= 1); AMP, NAL, SXT, TET (n= 3); AMP, GEN, NAL, SXT, TET (n= 1); CHL, CRO, TET (n= 1); AMP, GEN, TET (n= 1)	**United Kingdom**	2006-2012	[34]
64	40	AMP, SPT, STR, SXT, TET (n= 7); AMP, SPT, STR, SXT, TET, TMP (n= 27); AMP, CFP, SPT, STR, SXT, TET, TMP (n= 6)	**United Kingdom**	2010-2013	[44]
127	N/S	CTX	Italy	2013	[3]
242	1	ESBL	Portugal	2009-2011	[31]
93	N/S	CTX	Romania	2013	[3]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime
ESBL- Extended Spectrum Beta-Lactamase

Table 3.41: North, Central & South America- MDR phenotypes observed in *Salmonella* spp. isolates from pork meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
36	12	Most common resistance patterns: STR, SXT, TET (n= 3); CHL, STR, SXT, TET (n= 3); AMP, CHL, STR, SXT, TET (ACSuT pattern) (n= 3); AMP, CHL, STR, SXT, TET (ACSSuT pattern) (n= 2); AMC, AMP, CRO, STR (ACSSuT) (n= 1)	Canada (British Columbia, Saskatchewan, Ontario, Quebec, Maritimes region)	2003-2008	[36]
14	14	AMP, CEF, CHL, STR, SXT (n= 5); AMP, CHL, STR, SXT, TET (n= 4); GEN, KAN, SXT, TET (n= 2); AMP, NAL, TET (n= 2); AMP, CEF, KAN, TET (n= 1)	Mexico	2007-2008	[37]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.42: Africa- MDR phenotypes observed in *Salmonella* spp. isolates from pork meat

Note: No data were available in eligible studies

Table 3.43: Asia- MDR phenotypes observed in *Salmonella* spp. isolates from pork meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
12	5	NAL SXT, TET, TMP, SXT (n= 1); CHL, NAL, STR, SXT (n= 1); CAZ, SXT, TMP (n= 1); AMP, AMX, NAL, PEN, SXT, TET, TMP (n= 1); AMP, AMX, CHL, NAL, PEN, PIP, SXT, TMP (n= 1)	China	2005	[38]
35	10	AMP, AMP, AMX, CTX, STR, TET (n= 1); AMP, AMX, CHL, SXT, TET (n= 1); AMP, CHL, STR, SXT, TET (n= 2); AMP, STR, TET (n= 1); AMP, STR, SXT, TET (n= 3); AMP, NAL, STR, TET (n= 1); AMP, CHL, SXT, TET (n= 1)	Laos	2011	[43]
42	19	AMP, SXT, TET (n= 6); AMP, STR, TET (n= 4); AMP, CHL, TET (n= 1); AMP, STR, SXT, TET, (n= 3); AMP, CHL, SXT, TET, (n= 2); AMP, CHL, STR, TET (n= 1); CHL, CTX, STR, SXT, TET, (n= 1); CHL, CIP, CTX, OFX, STR, SXT, TET (n= 1)	Thailand	2010	[57]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

MDR phenotypes in *Salmonella* strains (excluding *S.* Derby, *S.* Typhymurium, *S.* Heidelberg, *S.* Infantis and *Salmonella* spp.)

Table 3.44: UK & Europe- MDR phenotypes observed in *Salmonella* isolates (excluding *S.* Derby, *S.* Typhymurium, *S.* Heidelberg, *S.* Infantis and *Salmonella* spp) from pork meat

Food item	Salmonella serovar	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Pork meat & offal	*Salmonella* (untypable)	8	4	**Most common MDR phenotype:** AMP, CHL, STR, SUL, TET, TMP (n= 2) Note: it was not possible to estimate the MDR phenotype for two of the isolates	**United Kingdom**	2003-2005	[1]
Pork meat	*S. enterica* 4-5-12:i:	30	19	AMP, SXT, STR, TET	**United Kingdom**	2006-2007	[49]
Pork meat	*S.* Mbandaka	1	1	CAZ, CTX	Estonia	2013	[3]
Pork meat	*S.* Rissen	1	1	CHL, STR, SXT, TET, TMP	Ireland	2007	[6]
Pork meat	*S.* Bovismorbificans	1	1	CTX	Latvia	2013	[3]
Pork meat	*S.* Agona	14	1	STR, SXT, TET	Romania	2001-2002	[25]
Pork meat	*S. enterica* (subsp.I) or 4-5-12:i	1	1	AMP, STR, SXT, TET	Sweden	2010-2011	[24]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.45: North, Central & South America- MDR phenotypes observed in *Salmonella* isolates (excluding *S.* Derby, *S.* Typhymurium, *S*. Heidelberg, *S*. Infantis and *Salmonella* spp) from pork meat

Salmonella serovar	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
S. Muenster	5	4	GEN, CLI, NAL, NEO, NIT, TET, SXT (n= 1); CLI, NAL, TET, SXT (n= 1); CLI, NAL, NEO, NIT, SXT (n= 1); CLI, NAL, TET (n= 1)	Colombia	N/S	[58]
S. Kottbus	1	1	CLI, NAL, TET	Colombia	N/S	[58]
S. Agona	1	1	STR, SXT, TET	United States	2001	[10]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX-** amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.46: Africa- MDR phenotypes observed in *Salmonella* isolates (excluding *S.* Derby, *S.* Typhymurium, *S*. Heidelberg, *S*. Infantis and *Salmonella* spp) from pork meat

Note: No data were available in eligible studies

Table 3.47: Asia- MDR phenotypes observed in *Salmonella* isolates (excluding *S.* Derby, *S.* Typhymurium, *S*. Heidelberg, *S*. Infantis and *Salmonella* spp) from pork meat

Salmonella serovar	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References

Salmonella serovar	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
S. Choleraesuis	1	1	CIP, SXT, TET	China	2007-2008	[52]
S. London	1	1	AMK, ATM, CAZ, CHL, SXT, TIM	China	2007-2008	[52]
S. Meleagridis	8	2	AMP, CFZ, CHL, NAL, SXT, TET; NAL, SXT, TET	China	2010-2012	[11]
S. Give	1	1	AMP, KAN, NAL, STR, SXT, TET	China	2010-2012	[11]
S. Anatum	6	2	AMP, GEN, MEZ, NAL, SXT, TET; AMP, CHL, MEZ, NAL, SXT	China	2010-2012	[11]
S. London	7	1	CHL, STR, SXT, TET	China	2010-2012	[11]
S. Muenster	1	1	AMP, CHL, KAN, SXT, TET	China	2010-2012	[11]
S. Meleagridis	4	1	AMP, STR, TET	China	2010-2012	[11]
S. Meleagridis	3	2	AMP, CHL, GEN, KAN, NAL, SXT, TET; AMP, CHL, KAN, NAL, STR, SXT, TET	China	2010-2012	[11]
S. London	1	1	ENR, NAL, SUL, STR, TET	Thailand	2004	[46]
S. Anatum	9	9	AMP, AMX, ENR TET, NAL, (n= 3); AMP, AMX, NAL TET, (n= 3); STR, SUL, TET (n= 2); AMP, AMX, STR, SUL, TET (n= 1)	Thailand	2004	[46]
S. Stanley	2	2	AMP, SXT, STR, TET ; AMP, NAL, STR, SXT, TET	Thailand	2006-2006	[59]
S. Rissen	13	N/S	AMP, STR, TET	Thailand	2010	[27]
S. Anatum	3	N/S	AMP, CEF, STR, TET	Thailand	2010	[27]
S. Give	4	3	TET, AMP, STR	Thailand	2010	[27]
S. Weltevreden	12	9	AMP, STR, TET, (n= 3); AMP, CEF, STR, TET (n= 2); AMP, CHL, STR, TET (n= 1); AMP, CEF, CHL, STR, TET (n= 1); AMP, CEF, NAL, STR, TET (n= 1); AMP, CHL, CIP, NAL, STR, TET (n= 1)	Thailand	2010	[27]
S. Kentucky	1	N/S	AMP, STR, TET	Thailand	2010	[27]
S. Bredeney	9	8	AMP. STR, TET (n= 1); CEF, STR, TET (n= 1); CHL, CEF, TET (n= 1); AMP, CHL, STR, TET (n= 1); AMP, CEF, STR, TET (n= 4)	Thailand	2010	[27]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Enterococcus faecalis

Table 3.48: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides observed in *E. faecalis* isolates from pork meat

Number of food samples	Number of isolates	PENICILLINS			2ND GEN. CEPHALOSPORINS		CARBAPENEMS		(FLUORO)QUINOLONES		MACROLIDES			Country	Year	References
		% AMC	% AMP	% PEN	% CXM	% FOX	%IPM	% MEM	% CIP	% ENR	% ERY	% OLE	% TYL			
255	161	--	--	--	--	--	--	--	0.6	--	8.1	--	8.1	**United Kingdom**	2001-2002	[60]
43	43	--	--	0	--	--	--	--	--	--	2	--	--	Denmark	1999	[61]
31	31	--	--	0	--	--	--	--	--	--	10	--	--	Denmark (domestic production)	2001	[15]
40	40	--	--	0	--	--	--	--	--	--	10	--	--	Denmark (domestic production)	2002	[16]
78	78	--	--	0	--	--	--	--	--	--	5	--	--	Denmark	2003	[17]
160	160	--	--	0	--	--	--	--	--	--	9	--	--	Denmark (domestic production)	2004	[18]
12	12	--	--	0	--	--	--	--	--	--	8	--	--	Denmark (imported, country of origin unknown)	2004	[18]
72	72	--	0	0	--	--	--	--	--	--	8	--	--	Denmark (domestic production)	2008	[62]
125	125	--	0	0	--	--	--	--	--	--	8	--	--	Denmark (imported, country of origin unknown)	2008	[62]
200	96	--	0	0	--	--	--	--	--	--	12	--	--	Denmark (domestic production)	2009	[63]
195	109	--	0	0	--	--	--	--	--	--	8	--	--	Denmark (imported, country of origin unknown)	2009	[63]
184	84	--	0	0	--	--	--	--	0	--	1	--	--	Denmark (domestic production)	2010	[64]
175	91	--	0	0	--	--	--	--	1	--	5	--	--	Denmark (imported, country of origin unknown)	2010	[64]
170	27	--	0	--	--	--	--	--	--	--	0	--	--	Denmark	2010	[65]

Number of food samples	Number of isolates	PENICILLINS			2ND GEN. CEPHALOSPORINS		CARBAPENEMS		(FLUORO)QUINOLONES		MACROLIDES			Country	Year	References
		% AMC	% AMP	% PEN	% CXM	% FOX	%IPM	% MEM	% CIP	% ENR	% ERY	% OLE	% TYL			
133	133	--	0	0	--	--	--	--	0	--	8	--	--	Denmark (domestic production)	2011	[64]
45	45	--	0	0	--	--	--	--	0	--	11	--	--	Denmark (imported, country of origin unknown)	2011	[64]
170	133	--	0	--	--	--	--	--	--	--	8.3	--	--	Denmark	2011	[66]
104	104	--	0	0	--	--	--	--	0	--	5	--	--	Denmark (domestic production)	2012	[67]
108	108	--	0	0	--	--	--	--	0	--	6	--	--	Denmark (imported, country of origin unknown)	2012	[67]
170	104	--	0	0	--	--	--	--	0	--	--	5	--	Denmark	2012	[7]
150	150	--	--	0	--	--	--	--	1	--	5	--	--	Denmark (domestic production)	2013	[68]
140	140	--	--	0	--	--	--	--	0	--	3	--	--	Denmark (imported, country of origin unknown)	2013	[68]
N/S	1^1	0	0	--	0	0	0	0	0	0	1	--	--	Germany	N/S	[69]
100	6^1	--	3	0	--	--	--	--	1	--	3	--	--	Greece	2010-2012	[70]
19	4^1	--	0	--	--	--	--	--	--	--	3	--	--	Italy	2002	[71]
79	18	0	0	0	--	--	--	--	16.7	--	--	--	--	Italy	2012	[72]
92	21	0	0	1	--	--	--	--	0	--	--	--	--	Italy	2012	[72]
N/S	410	--	0	--	--	--	--	--	0.7	--	7.3	--	--	Netherlands	2010-2011	[73]
N/S	847	--	0.1	--	--	--	--	--	0	--	2.2	--	--	Netherlands	2014	[74]
50	3^1	--	1	--	--	--	--	--	--	--	1	--	--	Sweden	2008	[75]
100	29	--	0	--	--	--	--	--	--	--	0	--	--	Sweden	2011	[76]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CIP**- ciprofloxacin; **CXM**- cefuroxime; **ENR**- enrofloxacin; **ERY**- erythromycin; **FOX**- cefoxitin; **IPM**- imipenem; **MEM**- meropenem; **OLE**- oleandomycin; **PEN**- penicillin (generic); **TYL**- tylosin

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.49: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides observed in *E. faecalis* isolates from pork meat

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES	MACROLIDES		Country	Year	References
		% PEN	% CIP	% ERY	% TYL			
133	92	--	--	8	9	Canada	2007 - 2008	[77]
10	12	8.3	8.3	8.3	8.3	United States	2000-2001	[78]
N/S	255	0	1.18	9.02	9.02	United States	2002	[14]
N/S	313	0	0	7.03	7.03	United States	2003	[14]
N/S	313	0	6.07	9.9	9.9	United States	2004	[14]
N/S	320	1.25	2.5	5.94	6.25	United States	2005	[14]
N/S	301	0	0.33	6.64	7.31	United States	2006	[14]
N/S	263	0	0	9.13	9.13	United States	2007	[14]
N/S	263	0.38	4.56	7.98	7.6	United States	2008	[14]
N/S	259	0.39	1.54	6.95	6.56	United States	2009	[14]
N/S	353	0.28	0	4.53	4.53	United States	2010	[14]
N/S	334	0	0.3	4.49	4.79	United States	2011	[14]
N/S	350	0	0.29	5.14	5.14	United States	2012	[14]
N/S	328	0	0	7.01	7.01	United States	2013	[14]

CIP- ciprofloxacin; **ERY**- erythromycin; **PEN**- penicillin (generic); **TYL**- tylosin

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.50: Africa - Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides observed in *E. faecalis* isolates from pork meat

Note: No data were available in eligible studies

Table 3.51: Asia - Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides observed in *E. faecalis* isolates from pork meat

Note: resistance to beta-lactams and fluoroquinolones was not explored in eligible studies.

Number of food samples	Number of isolates	MACROLIDES	Country	Year	References
		% ERY			
40	19	0	Korea, South	2010	[79]
34	4^[*1]	0	Korea, South	2010	[79]
34	5^[*1]	1	Korea, South	2010	[79]

ERY- erythromycin

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

MDR phenotypes in *Enterococcus faecalis*

Table 3.52: UK & Europe- MDR phenotypes observed in *E. faecalis* isolates from pork meat

Note: No data were available for the UK in eligible studies

No. of isolates tested	No. of MDR isolates	MDR phenotype	Country	Study year	Reference
6	N/S	AMP, CIP, ERY, TET	Greece	2010-2012	[70]
18	N/S	CHL, CIP, ERY, GEN, TET	Italy	2012	[72]
21	N/S	CHL, ERY, GEN, TET	Italy	2012	[72]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.53: North, Central & South America- MDR phenotypes observed in *E. faecalis* isolates from pork meat

Note: No data were available in eligible studies

Table 3.54: Africa - MDR phenotypes observed in *E. faecalis* isolates from pork meat

Note: No data were available in eligible studies

Table 3.55: Asia- MDR phenotypes observed in *E. faecalis* isolates from pork meat

Note: No data were available in eligible studies

Enterococcus faecium

Table 3.56: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from pork meat

Number of samples	Number of isolates	PENICILLINS			(FLUORO)QUINOLONES	MACROLIDES			Country	Year	References
		% AMC	% AMP	% PEN	% CIP	% ERY	% OLE	% TYL			
255	114	--	--	--	7	9.6	--	7	**United Kingdom**	2001-2002	[60]
N/S	17	--	--	--	--	--	--	5.9	Belgium	1998-2000	[80]
45	45	--	--	0	--	4	--	--	Denmark	1999	[61]
16	16	--	--	0	--	19	--	--	Denmark (domestic production)	2001	[15]
28	28	--	--	0	--	0	--	--	Denmark (domestic production)	2002	[16]
45	45	--	--	2	--	7	--	--	Denmark	2003	[17]
56	56	--	--	4	--	21	--	--	Denmark	2004	[18]
16	16	--	0	0	--	31	--	--	Denmark (imported, country of origin unknown)	2008	[62]
15	15	--	7	7	--	27	--	--	Denmark (domestic production)	2008	[62]
200	17	--	6	6	--	35	--	--	Denmark (domestic production)	2009	[63]
195	22	--	9	9	--	32	--	--	Denmark (imported, country of origin unknown)	2009	[63]
184	29	--	0	3	0	31	--	--	Denmark (domestic production)	2010	[64]
170	20	--	0	--	--	5	--	--	Denmark	2010	[65]
22	22	--	0	0	0	0	--	--	Denmark (imported, country of origin unknown)	2012	[67]

Number of samples	Number of isolates	PENICILLINS			(FLUORO)QUINOLONES	MACROLIDES			Country	Year	References
		% AMC	% AMP	% PEN	% CIP	% ERY	% OLE	% TYL			
27	27	--	0	0	0	15	--	--	Denmark (domestic, country of origin unknown)	2011	[64]
170	27	--	0	--	--	14.8	--	--	Denmark	2011	[66]
32	32	--	6	6	0	3	--	--	Denmark (imported, country of origin unknown)	2012	[67]
170	32	--	6.25	6.25	0	--	3.13	--	Denmark	2012	[7]
22	22	--	0	0	0	0	--	--	Denmark (domestic production)	2013	[68]
31	31	--	0	0	0	3	--	--	Denmark (imported, country of origin unknown)	2013	[68]
120	57	--	31.6	--	45.6	29.8	--	--	Greece	2004-2007	[81]
100	26	--	57.7	61.5	61.6	73.1	--	--	Greece	2010-2012	[70]
79	11	0	0	9	0	9.1	--	--	Italy	2012	[72]
92	14	0	0	0	0	.	--	--	Italy	2012	[72]
N/S	152	--	3.3	--	2.6	19.1	--	--	Netherlands	2010-2011	[73]
N/S	162	--	3.1	--	6.2	41.4	--	--	Netherlands	2014	[74]
40	3[*1]	--	1	--	0	0	--	--	Spain	N/S	[82]
50	17	--	0	--	--	0	--	--	Sweden	2008	[75]
100	1[*1]	--	0	--	--	0	--	--	Sweden	2011	[76]

AMP- ampicillin; **CIP**- ciprofloxacin; **ERY**- erythromycin; **OLE-** oleandomycin; **PEN**- penicillin (generic); **TYL**- tylosin

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.57: North, Central & South America - Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from pork meat

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES	MACROLIDES		Country	Year	References
		% PEN	% CIP	% ERY	% TYL			
133	2[*1]	--	0	--	--	Canada	2007- 2008	[77]
N/S	93	3.2	4.3	20.4	9.68	United States	2002	[14]
N/S	97	1	6.19	6.19	2.06	United States	2003	[14]
N/S	75	8	17.3	5.3	0	United States	2004	[14]
N/S	75	1.3	9.3	9.3	5.3	United States	2005	[14]
N/S	70	1.43	4.29	7.14	5.71	United States	2006	[14]
N/S	33	0	9.1	3	3	United States	2007	[14]
N/S	35	0	14.29	14.29	5.71	United States	2008	[14]
N/S	26	7.7	7.69	3.85	0	United States	2009	[14]
N/S	32	6.25	12.5	9.38	3.13	United States	2010	[14]
N/S	37	2.7	10.81	10.8	5.41	United States	2011	[14]
N/S	52	0	3.85	1.92	0	United States	2012	[14]
N/S	50	4	16	4	4	United States	2013	[14]

CIP- ciprofloxacin; **ERY**- erythromycin; **PEN**- penicillin (generic); **TYL**- tylosin

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.58: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from pork meat

Note: No data were available in eligible studies

Table 3.59: Asia - Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from pork meat

Note: No data were available in eligible studies

MDR phenotypes in *Enterococcus faecium*

Table 3.60: UK & Europe- MDR phenotypes observed in E*. faecium* isolates from pork meat

No. of isolates tested	No. of MDR isolates	MDR phenotype	Country of origin	Study year	Reference
6	6	ESBL producers (n= 5); AmpC producer (n= 1)	**United Kingdom**	2015	[83]
26	N/S	AMP, CHL, CIP, ERY, PEN, TET, Q-D, VAN, TEC	Greece	2010-2012	[70]
5	1	TEC, AMP, CHL, TET, ERY, Q-D, CIP	Spain	N/S	[82]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.61: North, Central & South America- MDR phenotypes observed in E*. faecium* isolates from pork meat

Note: No data were available in eligible studies

Table 3.62: Africa- MDR phenotypes observed in E*. faecium* isolates from pork meat

Note: No data were available in eligible studies

Table 3.63: Asia- MDR phenotypes observed in E*. faecium* isolates from pork meat

Note: No data were available in eligible studies

MDR phenotypes in *Enterococcus* spp.

Table 3.64: UK & Europe- MDR phenotypes observed in *Enterococcus spp*. isolates from pork meat

Note: No data were available in eligible studies in UK

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
26	N/S	AMP, CHL, CIP, ERY, PEN, Q-D, VAN, TEC, TET	Greece	2010-2012	[70]
6	N/S	AMP, CIP, ERY, TET	Greece	2010-2012	[70]
18	N/S	CHL, CIP, ERY, GEN, TET	Italy	2012	[72]
21	N/S	CHL, ERY, GEN, TET	Italy	2012	[72]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.65: North, Central & South America- MDR phenotypes observed in *Enterococcus* spp. isolates from pork meat

Note: No data were available in eligible studies

Table 3.66: Africa- MDR phenotypes observed in *Enterococcus* spp. isolates from pork meat

Note: No data were available in eligible studies

Table 3.67: Asia- MDR phenotypes observed in *Enterococcus* spp. isolates from pork meat

Note: No data were available in eligible studies

Escherichia coli

Table 3.68: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from pork meat

Food items	Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4TH GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)QUINOLONES			MACROLIDES	POLYMYXINS	Country	Year	References
			% AMC	% AMP	% PEN	% PIP	% CEF	% CFZ	% CEC	% CXM	% FOX	% CAZ	% CPD	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% AZM	% CST			
Pork meat	83	139	--	19	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	--	--	Austria	2001-2003	[84]
Pork meat	110	32	9.3	47	--	--	--	--	--	--	--	--	--	--	3.1	--	--	--	--	6.3	--	9.4	--	--	Czech Republic	2012-2013	[85]
Pork meat	66	66	--	29	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	2	--	2	--	--	Denmark (domestic production)	2008	[62]
Pork meat	96	96	--	30	--	--	--	--	--	--	--	--	--	--	1	1	--	--	--	6	--	4	--	--	Denmark (imported, country of origin unknown)	2008	[62]
Pork meat	170	68	--	24	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	1	--	1	--	0	Denmark	2010	[65]
Pork meat	170	92	--	--	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	1.1	--	--	--	--	Denmark	2011	[66]
Pork meat	170	73	--	32.9	2	--	--	--	--	--	--	--	--	--	1.4	--	--	--	--	1.4	--	0	--	0	Denmark	2012	[7]
Pork meat	80	80	--	8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	0	--	0	Denmark	1999	[61]
Pork meat	48	48	--	23	--	--	--	--	--	--	--	--	--	--	--	0	--	--	--	0	--	4	--	0	Denmark (domestic production)	2001	[15]
Pork meat	66	66	--	20	--	--	3	--	--	--	--	--	--	--	--	0	--	--	--	0	--	2	--	0	Denmark (domestic production)	2002	[16]
Pork meat	123	123	1	15	--	--	6	--	--	--	--	--	--	--	--	0	--	--	--	1	--	2	--	0	Denmark (domestic production)	2003	[17]

Food items	Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4TH GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)QUINOLONES			MACROLIDES	POLYMYXINS	Country	Year	References
			% AMC	% AMP	% PEN	% PIP	% CEF	% CFZ	% CEC	% CXM	% FOX	% CAZ	% CPD	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% AZM	% CST			
Pork meat	178	178	1	15	--	--	5	--	--	--	--	--	--	--	--	0	--	--	--	0	--	2	--	0	Denmark (domestic production)	2004	[18]
Pork meat	10	10	0	10	--	--	10	--	--	--	--	--	--	--	--	0	--	--	--	0	--	0	--	0	Denmark (imported, country of origin unknown)	2004	[18]
Pork meat	196	65	--	28	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	6	--	2	--	0	Denmark (imported, country of origin unknown)	2009	[63]
Pork meat	200	106	--	29	--	--	--	--	--	--	--	--	--	--	1	1	--	--	--	1	--	1	--	0	Denmark (domestic production)	2009	[63]
Pork meat	175	50	--	36	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	4	--	4	--	0	Denmark (imported, country of origin unknown)	2010	[64]
Pork meat	184	68	--	24	--	--	--	--	--	--	--	--	--	--	1	1	--	--	--	1	--	1	--	0	Denmark (domestic production)	2010	[64]
Pork meat	68	92	--	29	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	0	--	0	--	0	Denmark (domestic production)	2011	[64]
Pork meat	70	30	--	33	--	--	--	--	--	--	--	--	--	--	3	3	--	--	--	10	--	10	--	0	Denmark (imported, country of origin unknown)	2011	[64]
Pork meat	73	73	--	33	--	--	--	--	--	--	--	--	--	--	1	1	--	--	--	0	--	0	--	0	Denmark (domestic production)	2012	[67]
Pork meat	53	53	--	49	--	--	--	--	--	--	--	--	--	--	2	2	--	--	--	9	--	6	--	2	Denmark (imported, country of origin unknown)	2012	[67]
Mince meat	170	93	--	26.9	--	--	--	--	--	--	--	--	--	--	1.1	1.1	--	--	--	1.1	--	1.1	--	0	Denmark	2013	[3]
Pork	93	93	--	27	--	--	--	--	--	--	--	--	--	--	1	1	--	--	--	1	--	1	0	--	Denmark	2013	[68]

Food items	Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4TH GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)QUINOLONES			MACROLIDES	POLYMYXINS	Country	Year	References
			% AMC	% AMP	% PEN	% PIP	% CEF	% CFZ	% CEC	% CXM	% FOX	% CAZ	% CPD	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% AZM	% CST			
meat																									(domestic production)		
Pork meat	50	50	--	36	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	10	--	10	0	--	Denmark (imported, country of origin unknown)	2013	[68]
Pork meat	250	66	9.1	22.7	--	16.7	--	--	10.6	1.5	3	0	--	--	0	0	0	0	0	1.5	1.5	--	--	1.5	Germany	2004	[22]
Pork meat	120	51	49	78	--	--	--	--	--	29	--	--	--	16	--	--	--	12	--	16	--	--	--	--	Greece	2004-2007	[81]
Pork meat	60	50	--	8	--	--	--	--	--	--	--	--	--	--	2	0	--	--	--	8	6	8	--	--	Iceland	2006-2007	[86]
Pork meat	N/S	56		34	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	--	5	--	0	Netherlands	2006-2007	[87]
Pork meat	N/S	26		15	--	--	--	--	--	--	--	0	--	--	--	--	--	--	--	0	--	0	--	0	Netherlands	2008	[87]
Pork meat	N/S	13		30	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	--	0	--	0	Netherlands	2009	[87]
Pork meat	N/S	8**1		1	--	--	--	--	--	--	--	0	--	--	--	--	--	--	--	0	--	0	--	0	Netherlands	2010	[87]
Pork meat	N/S	186	--	23	--	--	--	--	--	--	--	2.2	--	--	1.6	--	--	--	--	2.7	--	2.2	--	--	Netherlands	2010-2011	[73]
Pork meat	N/S	178	--	23	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	--	0	--	0.5	Netherlands	2011	[87]
Pork meat	N/S	156	--	19	--	--	--	--	--	--	--	0.6	--	--	1.3	--	--	--	--	3.2	--	2.6	--	--	Netherlands	2013	[88]
Pork meat	N/S	331	--	12.7	--	--	--	--	--	--	--	0.9	--	--	0.9	--	--	--	0	3	--	2.7	0.9	0	The Netherlands	2014	[74]
Pork meat	78	4*1	--	4	--	--	--	4	--	--	0	4	4	4	4	--	0	0	0	4	--	--	--	--	Poland	N/S	[89]
Pork meat	78	2*1	--	2	--	--	--	1	--	--	2	1	2	0	0	--	0	0	0	0	--	--	--	--	Poland	N/S	[89]
Pork meat	54	90	--	23	--	--	6.7	--	--	--	--	--	--	--	--	--	--	--	--	--	0	--	--	--	Spain	2005	[90]

Food items	Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4TH GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)QUINOLONES			MACROLIDES	POLYMYXINS	Country	Year	References
			% AMC	% AMP	% PEN	% PIP	% CEF	% CFZ	% CEC	% CXM	% FOX	% CAZ	% CPD	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% AZM	% CST			
Pork meat	67	90	--	81	--	--	14	--	--	--	--	--	--	--	--	--	--	--	--	--	0	--	--	--	Spain	2005	[90]
Pork meat	50	19	--	5.3	--	--	--	--	--	--	--	--	--	--	0	--	--	--	--	0	--	5.3	--	--	Sweden	2008	[75]
Pork meat	44	1[*1]	--	1	--	--	--	--	--	--	--	1	--	--	1	--	--	0	--	1	--	0	--	--	Sweden	2010-2011	[24]
Pork meat	44	3[*1]	--	3	--	--	--	--	--	--	--	3	--	--	3	--	--	0	--	0	--	0	--	--	Sweden	2010-2011	[24]
Pork meat	20	3[*1]	--	3	--	--	--	--	--	--	--	3	--	--	3	--	--	0	--	1	--	1	--	--	Sweden	2010-2011	[24]
Pork meat	11	1[*1]	--	1	--	--	--	--	--	--	--	1	--	--	1	--	--	0	--	0	--	0	--	--	Sweden	2010-2011	[24]
Pork meat	100	20	--	30	--	--	--	--	--	--	--	--	--	--	0	--	--	--	--	10	--	0	--	0	Sweden	2011	[76]
Pork meat	50	23	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	Switzerland	2013	[91]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AZM**- azithromycin; ; **CAZ**- ceftazidime; **CEC**- cefaclor; **CEF**- cephalothin; **CFZ**- cephazolin; **CIP**- ciprofloxacin; **CPD**- cefpodoxime; **CRO**- ceftriaxone; **CTX**- cefotaxime; **CXM**- cefuroxime; **ENR**- enrofloxacin; **FEP**- cefepime; **FOX**- cefoxitin; **IPM-** imipenem**; MEM**- meropenem; **NAL**- nalidixic acid; **PEN**- penicillin (generic); **PIP**- piperacillin; **TIO**- Cefiofur

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.69: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from pork meat

Number of food samples	Number of isolates	PENICILLINS	1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS	(FLUORO) QUINOLONES	MACROLIDES	Country	Year	References

		% AMC	% AMP	% CEF	% CFZ	% FOX	% CRO	% TIO	% CIP	% NAL	% AZM			
75	75	--	--	--	--	--	2.7	--	--	--	--	Canada	2002	[8]
133	41	0	12	--	--	2.4	2.4	0	0	2.4	--	Canada	2007-2008	[8]
79	23	0	13	--	--	0	0	0	0	0	--	Canada (British Columbia)	2007	[92]
148	44	6.8	23	--	--	6.8	6.8	6.8	0	0	--	Canada (British Columbia)	2008	[36]
145	38	0	7.9	--	--	0	0	0	0	0	--	Canada (British Columbia)	2009	[93]
166	31	13	23	--	--	13	13	13	0	3.2	--	Canada (British Columbia)	2010	[94]
167	41	11	19	--	--	11	11	11	0	2.7	0	Canada (British Columbia)	2012	[95]
N/S	38	7.9	11	--	--	7.9	7.9	7.9	0	0	0	Canada (British Columbia)	2013	[95]
56	17	0	18	--	--	0	0	0	0	0	--	Canada (Maritimes region)	2008	[36]
200	81	1.2	12	--	--	0	0	0	0	1.2	--	Canada (Maritimes region)	2009	[93]
190	71	4.2	23	--	--	2.8	2.8	2.8	0	1.4	--	Canada (Maritimes region)	2010	[94]
N/S	91	6.6	20	7.7	--	3.3	0	1.1	0	0	--	Canada (Ontario)	2003	[35]
N/S	198	1.5	23	3	--	1.5	0	1	0	--	--	Canada (Ontario)	2004	[96]
303	179	2.3	21	--	--	1.7	0	1.2	0	0	--	Canada (Ontario)	2005	[97]
311	182	1	21	--	--	1.1	--	0.5	0	0	--	Canada (Ontario)	2006	[98]
320	172	1.2	23	--	--	1.2	0	0.6	0	0.6	--	Canada (Ontario)	2007	[92]
312	155	0.6	17	--	--	0.6	0.6	0.6	0	0	--	Canada (Ontario)	2008	[36]
328	136	0	18	--	--	0	0	0	0	0	--	Canada (Ontario)	2009	[93]
224	84	2.4	11	--	--	2.4	2.4	2.4	0	1.2	--	Canada (Ontario)	2010	[94]
231	86	2.3	29	--	--	2.3	2.3	1.2	0	0	0	Canada (Ontario)	2012	[95]
N/S	102	2.9	21	--	--	2.9	2.9	2	0	2	0	Canada (Ontario)	2013	[95]
N/S	61	1.6	20	9.9	--	6.6	0	--	0	0	--	Canada (Quebec)	2003	[35]
N/S	108	2.8	19	5.6	--	3.7	0	1.9	0	--	--	Canada (Quebec)	2004	[96]
300	78	2.6	12	--	--	2.6	0	2.6	0	0	--	Canada (Quebec)	2005	[97]
287	64	0	20	--	--	0	0	0	0	0	--	Canada (Quebec)	2007	[92]
270	57	0	19	--	--	0	--	0	0	0	--	Canada (Quebec)	2006	[98]

Number of food samples	Number of isolates	PENICILLINS		1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS		(FLUORO) QUINOLONES		MACROLIDES	Country	Year	References
		% AMC	% AMP	% CEF	% CFZ	% FOX	% CRO	% TIO	% CIP	% NAL	% AZM			
287	60	3.3	18	--	--	3.3	3.3	3.3	1.7	5	--	Canada (Quebec)	2008	[36]
268	41	0	20	--	--	0	0	0	0	0	--	Canada (Quebec)	2009	[93]
296	47	6.4	21	--	--	6.4	6.4	4.3	0	0	--	Canada (Quebec)	2010	[94]
279	44	2.3	18	--	--	2.3	0	0	0	2.3	0	Canada (Quebec)	2012	[95]
N/S	52	0	27	--	--	0	0	0	0	1.9	0	Canada (Quebec)	2013	[95]
160	48	0	2.1	--	--	0	0	0	0	0	--	Canada (Saskatchewan)	2005	[97]
156	49	0	6.1	--	--	0	--	0	0	0	--	Canada (Saskatchewan)	2006	[98]
154	38	2.6	5.3	--	--	2.6	0	2.6	0	0	--	Canada (Saskatchewan)	2007	[92]
176	41	7.3	9.8	--	--	7.3	7.3	7.3	0	2.4	--	Canada (Saskatchewan)	2008	[36]
164	29	3.4	10	--	--	3.4	3.4	3.4	0	0	--	Canada (Saskatchewan)	2009	[93]
142	17	0	18	--	--	0	0	0	0	0	--	Canada (Saskatchewan)	2010	[94]
140	26	3.8	19	--	--	3.8	3.8	3.8	0	0	0	Canada (Saskatchewan)	2012	[95]
N/S	29	3.4	14	--	--	3.4	3.4	3.4	0	0	0	Canada (Saskatchewan)	2013	[95]
60	78	--	32	22	--	--	--	--	9	--	--	Mexico	2008	[37]
1	1[*1]	--	--	--	--	--	1	--	--	--	--	United States	N/S	[99]
1	1[*1]	--	--	--	--	--	1	--	--	--	--	United States	N/S	[99]
49	37	--	42	26	--	--	0	0	0	10	--	United States	1999	[100]
209	52	--	24	26	--	--	4	2	0	12	--	United States	1999	[100]
50	3[*1]	0	1	--	0	--	--	--	0	0	--	United States	1999	[101]
N/S	184	5.4	14	--	--	3.3	0.5	0.5	0	0.5	--	United States	2002	[14]
N/S	218	5.1	13	--	--	2.3	0.9	0.9	0	10	--	United States	2003	[14]

Number of food samples	Number of isolates	PENICILLINS		1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS		(FLUORO) QUINOLONES		MACROLIDES	Country	Year	References
		% AMC	% AMP	% CEF	% CFZ	% FOX	% CRO	% TIO	% CIP	% NAL	% AZM			
N/S	232	5.6	15	--	--	2.2	0.4	0.4	0	0	--	United States	2004	[14]
N/S	205	2.9	16	--	--	1.5	0.5	0	0	1.5	--	United States	2005	[14]
180	180	8	26	--	--	7	0	0	0	0	--	United States	2006	[102]
N/S	182	2.2	16	--	--	1.7	0.6	0	0	0.6	--	United States	2006	[14]
N/S	152	0.7	16	--	--	0.7	0.7	0.7	0	0	--	United States	2007	[14]
N/S	146	3.4	15	--	--	3.4	3.4	3.4	0	0	--	United States	2008	[14]
N/S	147	6.8	12	--	--	6.8	6.8	6.8	0	0	--	United States	2009	[14]
N/S	183	2.2	19	--	--	0.6	0	0	0	0.6	--	United States	2010	[14]
N/S	146	0	13	--	--	0	0	0	0	0	0	United States	2011	[14]
N/S	161	3.1	13	--	--	1.9	1.2	1.2	0	0	0	United States	2012	[14]
N/S	208	1	12	--	--	1	1.4	1.4	0	0	0	United States	2013	[14]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AZM**- azithromycin; **CEF**- cephalothin; **CFZ**- cephazolin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **FOX**- cefoxitin; **NAL**- nalidixic acid; **TIO**- cefiofur

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.70: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from pork meat

Note: No data were available in eligible studies

Table 3.71: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from pork meat

Number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS			CARBAPENEMS	(FLUORO)QUINOLONES			POLYMYXINS	Country	Year	References
		% AMC	% AMP	% AMX	% CEF	% FOX	% CAZ	% CRO	% CTX	% MEM	% CIP	% ENR	% NAL	% CST			
118	118	--	--	--	--	--	--	--	22	--	22	--	--	--	China	2011	[103]
193	161	--	47	--	22	--	2	4	--	--	13	--	--	--	China	2012-2013	[104]
50	20	16	84	84	32	--	--	--	--	--	53	63	68	--	Vietnam	2004	[56]
50	4[*1]	0	3	3	0	--	--	--	--	--	2	3	3	--	Vietnam	2004	[56]
50	20	0	55	55	5	--	--	--	--	--	15	20	30	--	Vietnam	2004	[105]
147	147	--	100	--	--	16	18	--	100	0	38	--	48	--	Vietnam	2013	[106]
147	47	--	100	--	--	12	18	--	100	0	38	--	45	--	Vietnam	2013	[107]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **CAZ**- ceftazidime; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; CST- colistin; **CTX**- cefotaxime; **ENR**- enrofloxacin; **FOX**- cefoxitin; **MEM**- meropenem; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

MDR phenotypes in *Escherichia coli*

Table 3.72: UK & Europe- MDR phenotypes observed in *E.coli* isolates from pork meat

Note: No data were available for the UK in eligible studies.

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
32	9	AMP, AMC, STR, SXT, TMP, TET (n= 1); AMP, AMC, CIP, GEN, NAL, TET (n= 1); AMP, AMC, CTX, GEN, STR, TET (n= 1); NAL, STR, TET (n= 1); AMP, STR, SXT, TET, TMP (n= 2); AMP, SXT, TET, TMP (n= 2); AMP, CIP, CHL, KAN, NAL, STR, SXT, TET, TMP (n= 1)	Czech Republic	2012-2013	[85]
51	24	AMK, AMP, CAR, TET, TIC (n= 5); AMP, CIP, CXM, NIT, TET (n= 5); AMP, CAR, TET (n= 5); AMK, AMP, CAR, GEN, NIT, TET, TIC (n= 3); AMP, AMC, NIT, SAM, TIC, TET (n= 3); AMP, AMC, CAR, SAM, NIT, TET (n= 3)	Greece	2004-2007	[81]
186	3	ESBL-producers	Netherlands	2010-2011	[73]
728	112	ESBL-producers	Netherlands	2013	[88]
757	20	ESBL-producers	Netherlands	2014	[74]
549	22	ESBL-producers	Netherlands	2014	[74]
6	4	ESBL-producers (n= 2); AmpC-producers (n= 2)	Poland	2012-2013	[108]
12	3	ESBL-producers	Spain	2006-2007	[109]
19	1	AMP, CHL, SXT (n= 1)	Sweden	2008	[75]
20	2	AMP, STR, SXT (n= 1); AMP, STR, SXT,KAN (n= 1)	Sweden	2011	[76]
1	1	ESBL-producers: AMP, NAL, KAN, STR, SXT, TET (n= 1)	Sweden	2010-2011	[24]
3	3	ESBL-producers: AMP, STR, SXT, TET (n= 1); ESBL-producers: AMP, KAN, SXT, STR (n= 1); ESBL-producers: AMP, KAN, SXT, TET (n= 1)	Sweden	2010-2011	[24]
2	2	ESBL-producers: AMP, SXT, TET (n= 1); ESBL: AMP, CIP, CHL, NAL, STR, SXT, TET (n= 1)	Sweden (imported from Italy)	2010-2011	[24]
1	1	ESBL-producers: AMP, CHL, FFC, STR, SXT,TET	Sweden (imported from Poland)	2010-2011	[24]
23	0	No MDR isolates were detected	Switzerland	2013	[91]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**-carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**-cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**-cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**-erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**-gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**-lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**-miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**-ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**-spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**-piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.73: North, Central & South America- MDR phenotypes observed in *E.coli* isolates from pork meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
44	N/S	Most common resistance patterns: AMP, CHL, STR, SXT, TET (ACSSuT) (n= 3); AMP, KAN, STR, SXT, TET (AKSSuT) (n= 1); AMP, CHL, KAN, STR, SXT, TET (ACKSSuT) (n= 1); AMC, ACSSuT (n= 1). Resistance pattern involving the greatest number of antimicrobials: ACSSuT, AMC, CRO, SXT (1 isolate from Ontario).	Canada (British Columbia & Ontario)	2008	[36]
91	2	AMP, CHL, STR, SXT, TET (ACSSuT pattern) (n= 1); AMC, AMP, CEF, CHL, STR, SXT, TET, TIO (n= 1)	Canada (Ontario)	2003	[35]
306	N/S	AMP, CHL, STR, SXT, TET (ACSSuT) (n= 2); AMP, KAN, STR, SXT, TET (AKSSuT) (n= 6); AMP, CHL, KAN, STR, SXT, TET (ACKSSuT) (n= 3); AMC, AMP, KAN, STR, SXT, TET (AMC+AKSSuT) (n= 1)	Canada (Ontario & Quebec)	2004	[96]
297	N/S	Most common resistance patterns: AMP, STR, TET (n= 13); AMP, CHL, STR, SXT, TET (ACSSuT) (n= 3); AMP, KAN, STR, SXT, TET (AKSSuT) (n= 3).	Canada (Ontario, Quebec, Saskatchewan, British Columbia)	2007	[92]
325	N/S	Most common resistance patterns: AMP, CHL, STR, SXT, TET (ACSSuT) (n= 9); AMP, KAN, STR, SXT, TET (AKSSuT) (n= 3); AMP, CHL, KAN, STR, SXT, TET (ACKSSuT) (n= 2)	Canada (Ontario, Quebec, Saskatchewan, British Columbia, Maritimes region)	2009	[93]
250	7	AMP, CHL, STR, SXT, TET (ACSSuT) (n= 3); AMP, KAN, STR, SXT, TET (AKSSuT) (n= 1); AMP, KAN, STR, SXT, TET (ACKSSuT) (n= 2); ACSSuT, AMC (n= 1)	Canada (British Columbia, Saskatchewan, Ontario, Quebec, Maritimes region)	2010	[94]
305	N/S	CHL, SXT, TET (n= 8); AMC, AMP (n=13); AMP, CHL, STR, SXT, TET (ACSSuT) (n= 3); AMP, KAN, STR, SXT, TET (AKSSuT) (n= 3); AMP, CHL, KAN, STR, SXT, TET (ACKSSuT)	Canada (Ontario, Quebec, Saskatchewan)	2005	[97]
288	10	AMP, CHL, STR, SXT, TET (ACSSuT) (n= 6); AMP, KAN, STR, SXT, TET (AKSSuT) (n= 4);	Canada (Ontario, Quebec, Saskatchewan)	2006	[98]
61	2	AMP, CHL, STR, SXT, TET, (ACSSuT pattern)	Canada (Quebec)	2003	[35]
12	1	ESBL-producer (all of which were CMY-type Beta Lactamase producing *E coli*)	United States	2007	[110]
20	2	ESBL-producers	United States	2006-2007	[109]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Ceftiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.74: Africa- MDR phenotypes observed in *E.coli* isolates from pork meat

Note: No data were available in eligible studies

Table 3.75: Asia- MDR phenotypes observed in *E. coli* in pork meat at retail level

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
118	26	ESBL-producers: AMP, CAZ, CTX, CIP, CHL, GEN, SXT, TET (n= 14); ESBL-producers: AMP, CAZ, CTX, CIP, CHL, SXT, TET (n= 8); ESBL-producers: AMP, CAZ, CTX, CIP, GEN, SXT, TET (n= 3); ESBL-producers: AMP, CAZ, CTX, CIP, TET (n= 1)	China	2011	[103]
N/S	12	AMP, CEF, CHL, DOX, GEN, KAN, NAL, STR, SXT, TET (n= 1); AMP, CHL, CIP, DOX, GEN, KAN, NAL, NOR, STR, SXT, TET (n= 2); ATM, CEF, CHL, CIP, CTX, CXM, DOX, GEN, KAN, NAL, NOR, MAR, STR, SXT, TET (n= 1); AMP, AMC, CIP, CHL, DOX, GEN, KAN, NOR, STR, SXT, TET, TMP (n= 2); AMP, CEF, CHL, CIP, DOX, GEN, KAN, NOR, STR, SXT, TET (n= 1); CHL, CIP, DOX, GEN, NAL, NOR, KAN, STR, SXT, TET, TMP, (n= 1); AMP, AMC, CEF, CHL, CIP, CXM, DOX, GEN, KAN, NAL, NOR, STR, SXT, TET (n= 1); CEF, CHL, CIP, CTX, CXM, DOX, GEN, KAN, MAR, NAL, NOR, STR, SXT, TET,(n= 1); AMP, AMC, CHL, CIP, DOX, GEN, KAN, NAL, NOR, STR, SXT, TET FFC (n= 1); AMP, AMC, CEF, CIP, CHL, DOX, GEN, KAN, NAL, NOR, STR, SXT, TET (n= 1)	China	2012	[111]
N/S	7	AMP, SUL, CAZ, CTX, KAN, NAL, TET (n= 1); AMP, CAZ, CIP, CTX, GEN, NAL, STR, SXT, TET (n= 2); AMP, CAZ, CHL, CIP, CTX, KAN, NAL, STR, SXT, TET (n= 1); AMP, CAZ, CHL, CIP, CTX, GEN, LEV, KAN, NAL, STR, SXT, TET (n= 1); AMP, SUL, CAZ, CHL, CIP, CFP, CTX, GEN, LEV, KAN, NAL, STR, SXT, TET (n= 1); AMP, SUL, CAZ, FEP, CHL, CIP, CFP, CTX, LEV, KAN, NAL, STR, SXT, TET (n= 1)	China	2013	[112]

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
5	2	ESBL-producers (0% resistance to CST)	Thailand	2012	[113]
9	4	ESBL-producers (0% resistance to CST)	Thailand (Bangkok)	2012	[113]
4	4	ESBL-producers (0% resistance to CST)	Thailand (Central Province)	2012	[113]
20	8	AMP, AMX, CHL, ENR, GEN, KAN, NAL, SUL, STR, TET, TMP (n= 1); AMP, AMX, CEF, ENR, GEN, NAL, NOR, STR, SUL, TET (n= 1); AMC, AMP, AMX, CEF, CHL, STR, SUL, TET, TMP (n= 1); AMC, AMP, AMX, CEF, CIP, ENR, GEN, NAL, NOR, SUL, STR, TET, TMP (n= 1); AMP, AMX, CHL, GEN, SUL, STR, TET, TMP (n= 1); AMC, AMP, AMX, ENR, CEF, CHL, NAL, STR, SUL, TET, TMP (n= 1); AMC, AMP, AMX, CEF, CHL, CIP, ENR, GEN, KAN, NAL, NOR, SUL, STR, TET, TMP (n= 1); AMC, AMP, AMX, CEF, CHL, CIP, ENR, NAL, NOR, SUL, STR, TET, TMP (n= 1)	Vietnam	2004	[56]
4	4	AMP, AMX, ENR, GEN, NAL, STR, SUL, TET (n= 1); CIP, ENR, GEN, NOR, STR, SUL, TET, TMP, NAL (n= 1); AMP, AMX, GEN, SUL, TET, TMP (n= 1); AMP, AMX, CHL, CIP, ENR, NAL, NOR, STR, SUL, TET, TMP (n= 1)	Vietnam	2004	[56]
147	47	ESBL-producers	Vietnam	2013	[106]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

2. Poultry meat

Campylobacter spp

Table 3.76: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *Campylobacter spp* isolates from poultry meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES			MACROLIDES	Country	Year	References
		% AMP	% CIP	% NAL	% ENR	% ERY			
788	33	74	27	29	--	8	**United Kingdom**	2004	[28]
1,533	788	74	27	29	--	8	**United Kingdom**	2004	[28]
208	197	26	38	39	--	3	Belgium	2004	[28]
1,477	157	20	56	50	--	3	Netherlands	2004	[28]
1,067	331	9.1	--	0	0	0	Norway	2004	[28]

AMP- ampicillin; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid.

Table 3.77: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *Campylobacter spp* isolates from chicken meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS			(FLUORO)-QUINOLONES			MACROLIDES		Country	Year	References
		% AMC	% AMP	% PEN	% CIP	% NAL	% ENR	% AZM	% ERY			
860	457	--	--	--	25.4	--	--	--	8.3	**United Kingdom**	2006	[29]
N/S	105	--	24.8	--	12.4	12.4	--	--	1.9	**United Kingdom**	2006	[114]
412	3[^1]	--	--	3	1	3	--	--	0	**United Kingdom**	1995-2001	[115]
30	120	--	--	--	0	95	--	--	100	**United Kingdom**	N/S	[116]
30	150	--	--	--	11.6	82.1	--	--	100	**United Kingdom**	N/S	[116]
30	125	--	--	--	2.9	100	--	--	100	**United Kingdom**	N/S	[116]
112	91	--	--	--	41.8	--	--	--	3.3	Belgium	2006	[29]
2,686	76	--	--	--	5.3	--	--	--	1.3	Denmark	2005	[33]
580	48	--	23	--	50	50	--	--	14	Estonia	2002	[117]
517	36	--	--	--	16.7	19.4	--	--	0	Estonia	2012	[118]
113	113	38.1	61.9	--	38.1	76.2	--	--	57.1	Italy	2012	[119]
517	16	--	--	--	87.5	87.5	--	--	0	Latvia	2012	[118]
517	46	--	--	--	84.8	80.4	--	--	2.2	Lithuania	2012	[118]
938	35	--	3	--	--	--	0	--	0	Norway	2005	[33]
161	97	--	--	--	71.1	--	--	0	0	Poland	2009	[120]
148	68	--	--	--	58.8	--	--	2.9	2.9	Poland	2010	[120]
140	54	--	--	--	63	--	--	0	9.3	Poland	2011	[120]
143	42	--	--	--	73.8	--	--	0	0	Poland	2012	[120]
150	48	--	--	--	64.4	--	--	0	2.1	Poland	2013	[120]
158	65	--	--	--	18	--	--	--	10	Slovenia	2002-2003	[121]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AZM**- azithromycin; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid; **PEN**- penicillin (generic)

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.78: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *Campylobacter* spp. isolates from turkey meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS			(FLUORO)QUINOLONES			MACROLIDES		Country	Year	References
		% AMC	% AMP	% PEN	% CIP	% NAL	% ENR	% AZM	% ERY			
152	788	--	74	--	27	29	--	--	8	**United Kingdom**	2004	[28]
30	22	--	59	--	100	100	--	--	0	Estonia	2002	[117]
113	95	59.1	77.3	--	54.5	81.8	--	--	86.4	Italy	2012	[119]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AZM**- azithromycin; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid; **PEN**- penicillin (generic)

Table 3.79: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *Campylobacter* spp. isolates from poultry meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS		CARBAPENEMS	(FLUORO)QUINOLONES			MACROLIDES		Country	Year	References
		% AMC	% AMP	% MEM	% ENR	% CIP	% NAL	% AZM	% ERY			
N/S	12	--	--	--	25	33	42	--	--	United States	1999-2000	[122]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AZM**- azithromycin; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid

Table 3.80: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *Campylobacter* spp. isolates from chicken meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS		CARBAPENEMS	(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% MEM	% CIP	% NAL	% AZM	% ERY			
60	24	--	--	0	75	--	--	--	Brazil	N/S	[123]
1,256	749	0	7.3	--	1.9	1.9	--	3.3	Canada	2001-2004	[124]
N/S	94	--	--	--	3.2	5.3	22	22	Canada	2003	[35]
336	172	--	--	--	6	--	--	--	Canada	2003	[125]
N/S	78	--	--	--	3.9	10.3	10.3	7.8	Canada	2003	[35]

Number of food samples	Number of isolates	PENICILLINS		CARBAPENEMS	(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% MEM	% CIP	% NAL	% AZM	% ERY			
638	298	--	--	--	7	--	--	--	Canada	2004	[125]
N/S	158	--	--	--	0	0	0	0	Canada	2004	[96]
N/S	140	--	--	--	0	0	0	0	Canada	2004	[96]
N/S	7[*1]	--	--	--	3	3	0	0	Canada	2005	[97]
300	120	--	--	--	2	2	5	5	Canada	2005	[97]
747	275	--	--	--	5	--	--	--	Canada	2005	[125]
N/S	7[*1]	--	--	--	3	3	1	1	Canada	2005	[97]
303	103	--	--	--	1.5	1.5	12	12	Canada	2005	[97]
141	52	--	--	--	5	7	0	0	Canada	2005	[97]
N/S	3[*1]	--	--	--	2	2	0	0	Canada	2005	[97]
288	100	--	--	--	3	2	9	8	Canada	2006	[98]
155	51	--	--	--	3	2	2	2	Canada	2006	[98]
311	104	--	--	--	5	3	4	4	Canada	2006	[98]
755	256	--	--	--	6	--	--	--	Canada	2006	[125]
N/S	1[*1]	--	--	--	0	0	0	0	Canada	2006	[98]
N/S	1[*1]	--	--	--	0	0	0	0	Canada	2007	[92]
828	253	--	--	--	13	--	--	--	Canada	2007	[125]
320	117	--	--	--	1	1	1.5	1.5	Canada	2007	[92]
N/S	3[*1]	--	--	--	0	0	0	0	Canada	2007	[92]
287	59	--	--	--	15	13	10	10	Canada	2007	[92]
80	28	--	--	--	4	4	0	0	Canada	2007	[92]
141	49	--	--	--	7	6	2	2	Canada	2007	[92]

Number of food samples	Number of isolates	PENICILLINS		CARBAPENEMS	(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% MEM	% CIP	% NAL	% AZM	% ERY			
287	54	--	--	--	0	0	11	12	Canada	2008	[36]
959	266	--	--	--	13	--	--	--	Canada	2008	[125]
161	40	--	--	--	10	10	0	0	Canada	2008	[36]
145	50	--	--	--	7	8	0	0	Canada	2008	[36]
311	120	--	--	--	4	4	7	8	Canada	2008	[36]
146	77	--	--	--	28	30	0	0	Canada	2009	[93]
1089	325	--	--	--	32	--	--	--	Canada	2009	[125]
328	101	--	--	--	2	1	5	6	Canada	2009	[93]
266	52	--	--	--	0	0	10	10	Canada	2009	[93]
199	47	--	--	--	6	5	8	8	Canada	2009	[93]
N/S	1[*1]	--	--	--	1	1	0	0	Canada	2009	[93]
150	48	--	--	--	15	15	0	0	Canada	2009	[93]
190	68	--	--	--	5	4	0	0	Canada	2010	[94]
165	70	--	--	--	15	18	3	3	Canada	2010	[94]
232	64	--	--	--	5	6	10	12	Canada	2010	[94]
N/S	1[*1]	--	--	--	1	1	0	0	Canada	2010	[94]
132	36	--	--	--	11	12	3	3	Canada	2010	[94]
N/S	1[*1]	--	--	--	1	1	0	0	Canada	2010	[94]
1015	301	--	--	--	23	--	--	--	Canada	2010	[125]
296	63	--	--	--	2	1	3	3	Canada	2010	[94]
N/S	2[*1]	--	--	--	1	1	0	0	Canada	2010	[94]
N/S	4[*1]	--	--	--	2	2	0	0	Canada	2010	[94]

Number of food samples	Number of isolates	PENICILLINS		CARBAPENEMS	(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% MEM	% CIP	% NAL	% AZM	% ERY			
140	40	--	--	--	2	2	1	1	Canada	2012	[95]
226	88	--	--	--	14	14	6	6	Canada	2012	[95]
N/S	3[*1]	--	--	--	3	3	0	0	Canada	2012	[95]
274	79	--	--	--	2	2	6	6	Canada	2012	[95]
N/S	1[*1]	--	--	--	0	0	0	0	Canada	2012	[95]
166	73	--	--	--	6	6	--	--	Canada	2012	[95]
N/S	57	--	--	--	9.5	9.5	0	0	Canada (British Columbia)	2013	[126]
50	57	--	--	--	15	15	0	0	Canada	2013	[126]
120	25	--	--	--	1	1	0	0	Canada	2013	[126]
234	84	--	--	--	7	7	8	8	Canada	2013	[126]
N/S	84	--	--	--	36	36	7.1	7.1	Canada (Ontario)	2013	[126]
N/S	54	--	--	--	0	0	12.5	12.5	Canada (Quebec)	2013	[126]
243	54	--	--	--	2	2	6	6	Canada (Quebec)	2013	[126]
165	27	--	--	--	70	--	--	48	Colombia	2008-2013	[127]
1,302	717	--	--	--	85.1	--	--	6.9	Mexico	2003-2006	[128]
N/S	90	--	--	--	16	--	--	7	United States	2002	[14]
N/S	142	--	--	--	19	--	--	11	United States	2003	[14]
45	43	--	--	--	74.4	--	--	--	United States	2003	[129]
45	33	--	--	--	12.1	--	--	--	United States	2003	[129]
118	88	--	--	--	3.4	--	--	--	United States	2004	[130]
80	64	--	--	--	26.6	--	--	--	United States	2004	[130]
N/S	196	--	--	--	33	32	19	18	United States	2004	[14]

Number of food samples	Number of isolates	PENICILLINS		CARBAPENEMS	(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% MEM	% CIP	% NAL	% AZM	% ERY			
176	130	--	--	--	27.7	--	--	--	United States	2004	[131]
N/S	151	--	--	--	45	44	15	15	United States	2005	[14]
176	170	--	--	--	44.7	--	--	--	United States	2005	[131]
N/S	145	--	--	--	32	30	9	8	United States	2006	[14]
392	248	--	--	--	46	--	--	--	United States	2006	[131]
90	77	--	--	--	40.2	--	--	--	United States	2006	[130]
120	100	--	--	--	6	--	--	--	United States	2006	[130]
N/S	143	--	--	--	37	37	10	10	United States	2007	[14]
141	117	--	--	--	8.5	--	--	23.9	United States	2007	[132]
53	48	--	--	--	0	--	--	10.4	United States	2007	[132]
N/S	181	--	--	--	37	37	18	18	United States	2008	[14]
N/S	176	--	--	--	32	32	8	8	United States	2009	[14]
N/S	148	--	--	--	20	21	6	6	United States	2010	[14]
N/S	210	--	--	--	38	38	9	11	United States	2011	[14]
N/S	193	--	--	--	60	60	23	22	United States	2012	[14]
231	25	--	--	--	25	24	3	7	United States	2012	[133]
N/S	198	--	--	--	40	40	19	19	United States	2013	[14]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AZM**- azithromycin; **CIP**- ciprofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.81: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *Campylobacter* spp. isolates from turkey meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS		CARBAPENEMS	(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% MEM	% CIP	% NAL	% AZM	% ERY			
246	15	--	--	--	0	0	0	0	Canada	2012	[95]
223	20	--	--	--	0	0	2	2	Canada	2012	[95]
153	33	--	--	--	7	7	0	0	Canada	2012	[95]
N/S	1[*1]	--	--	--	35.7	35.7	7.1	7.1	Canada	2013	[126]
N/S	28	--	--	--	9	9	0	0	Canada	2013	[126]
N/S	54	--	--	--	9.5	9.5	0	0	Canada (Quebec)	2013	[126]
N/S	16	--	--	--	2	2	0	0	Canada	2013	[126]
N/S	27	--	--	--	0	0	1	1	Canada	2013	[126]
N/S	2[*1]	--	--	--	1	--	--	0	United States	2002	[14]
N/S	1[*1]	--	--	--	1	--	--	0	United States	2003	[14]
N/S	5[*1]	--	--	--	0	0	0	0	United States	2004	[14]
N/S	9[*1]	--	--	--	5	5	2	2	United States	2005	[14]
N/S	10	--	--	--	30	30	0	0	United States	2006	[14]
N/S	14	--	--	--	7	7	0	0	United States	2007	[14]
N/S	19	--	--	--	9	9	1	1	United States	2008	[14]
N/S	16	--	--	--	7	7	0	0	United States	2009	[14]
N/S	7[*1]	--	--	--	4	4	1	1	United States	2010	[14]
N/S	18	--	--	--	9	9	1	1	United States	2011	[14]
N/S	3[*1]	--	--	--	2	2	0	0	United States	2012	[14]

Number of food samples	Number of isolates	PENICILLINS		CARBAPENEMS	(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% MEM	% CIP	% NAL	% AZM	% ERY			
N/S	5[*1]	--	--	--	0	0	0	0	United States	2013	[14]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AZM**- azithromycin; **CIP**- ciprofloxacin; **ERY**- erythromycin; **MEM-** meropenem; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.82: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *Campylobacter* spp. isolates from poultry meat

Note: No data were available in eligible studies

Table 3.83: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *Campylobacter* spp. isolates from poultry meat

Note: No data were available in eligible studies

Campylobacter coli

Table 3.84: UK & Europe- Antimicrobial resistance beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. coli* isolates from poultry meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS		3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLUORO)QUINOLONES			MACROLIDES			Country	Year	Reference
		% AMC	% AMP	% PEN	% AMX	% CEF	% FAM	% FOX	% CTX	% IPM	% CIP	% ENR	% NAL	% ERY	% CLR	% AZM			
35	1[*1]	--	1	--	--	--	--	--	--	--	--	--	--	0	--	--	**United Kingdom**	2003-2005	[134]
77	11	--	45.5	--	--	--	--	--	--	--	--	--	--	36.3	--	--	**United Kingdom**	2003-2005	[134]
113	15	40	60	--	--	--	--	--	--	--	26.7	--	66.7	53.3	--	--	Italy	2012	[119]
N/S	72	--	76.4	--	--	--	--	--	--	--	81.9	--	80.6	16.7	15.3	--	The Netherlands	2013	[88]
N/S	84	--	--	--	--	--	--	--	--	--	76.2	--	76.2	21.4	--	--	The Netherlands	2014	[74]
N/S	103	--	42.7	--	--	--	--	--	--	--	80.6	--	80.6	32	31.1	--	The Netherlands	2010-2011	[73]
368	180	--	--	--	--	--	--	--	--	--	86.1	--	85	0.8	--	--	Poland	2009-2011	[135]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **AZM**- azithromycin; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CLR**- clarythromycin; **CTX**- cefotaxime; **ENR**- enrofloxacin; **ERY**- erythromycin; **IPM-** imipenem; **FAM-** cefamandole; **FOX-** cefoxitin; **NAL**- nalidixic acid; **PEN**- penicillin (generic)

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.85: UK & Europe- Antimicrobial resistance beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. coli* isolates from chicken meat

Note: resistance to polymyxins was not explored in eligible studies.

Food items	Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS		3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLUORO)QUINOLONES			MACROLIDES			Country	Year	Reference
			% AMC	% AMP	% PEN	% AMX	% CEF	% FAM	% FOX	% CTX	% IPM	% CIP	% ENR	% NAL	% ERY	% CLR	% AZM			
Chicken meat	150	9[*1]	--	--	9	--	--	--	--	--	--	0	--	0	0	--	--	**United Kingdom**	1995-2000	[115]
Chicken meat	412	64	--	--	100	--	--	--	--	--	--	9.4	--	10.9	6,2	--	--	**United Kingdom**	1995-2001	[115]
Chicken meat	N/S	51	--	--	--	--	--	--	--	--	--	20	--	20	5	--	--	**United Kingdom**	2001	[136]
Chicken meat (conventional farming)	3,882	330	--	21.5	--	--	--	--	--	--	--	13.9	--	17	6.4	--	--	**United Kingdom**	2001	[137]
Chicken meat (free range farming)	147	30	--	16.7	--	--	--	--	--	--	--	0	--	0	0	--	--	**United Kingdom**	2001	[137]
Chicken meat (organic farming)	44	16	--	6.3	--	--	--	--	--	--	--	12.5	--	12.5	0	--	--	**United Kingdom**	2001	[137]
Chicken meat (conventional farming)	49	1[*1]	--	0	--	--	--	--	--	--	--	0	--	0	0	--	--	**United Kingdom**	2001	[137]
Chicken meat (conventional farming)	211	11	--	63.6	--	--	--	--	--	--	--	36.4	--	36.4	9.1	--	--	**United Kingdom**	2001	[137]
Chicken meat (free range farming)	21	8[*1]	--	2	--	--	--	--	--	--	--	1	--	1	0	--	--	**United Kingdom**	2001	[137]
Chicken meat (organic farming)	26	5[*1]	--	0	--	--	--	--	--	--	--	2	--	2	0	--	--	**United Kingdom**	2001	[137]
Chicken meat (conventional farming)	109	4[*1]	--	2	--	--	--	--	--	--	--	0	--	0	0	--	--	**United Kingdom**	2001	[137]
Chicken meat	23	1[*1]	--	0	--	--	--	--	--	--	--	0	--	0	0	--	--	**United Kingdom**	2001	[137]

Food items	Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS		3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLUORO)QUINOLONES			MACROLIDES			Country	Year	Reference
			% AMC	% AMP	% PEN	% AMX	% CEF	% FAM	% FOX	% CTX	% IPM	% CIP	% ENR	% NAL	% ERY	% CLR	% AZM			
(conventional farming)																				
Chicken meat(conventional farming)	151	5[*1]	--	2	--	--	--	--	--	--	--	4	--	4	1	--	--	**United Kingdom**	2001	[137]
Chicken meat (conventional farming)	96	15	--	13.3	--	--	--	--	--	--	--	13.3	--	13.3	0	--	--	**United Kingdom**	2001	[137]
Chicken meat	1,778	25	--	52	--	--	--	--	--	--	--	--	--	--	4	--	--	**United Kingdom**	2003-2005	[134]
Chicken meat	N/S	210	--	--	--	--	--	--	--	--	--	24	--	24	13	--	--	**United Kingdom**	2004-2005	[136]
Chicken meat (conventional farming)	2,573	399	--	83.7	--	--	--	--	--	--	--	34.1	--	36.1	26.8	--	--	**United Kingdom**	2007-2008	[138]
Chicken meat (free-range farming)	156	46	--	89.1	--	--	--	--	--	--	--	54.3	--	54.3	8.7	--	--	**United Kingdom**	2007-2008	[138]
Chicken meat (organic farming)	28	9[*1]	--	9	--	--	--	--	--	--	--	7	--	7	0	--	--	**United Kingdom**	2007-2008	[138]
Chicken meat (conventional farming)	176	2[*1]	--	0	--	--	--	--	--	--	--	1	--	1	1	--	--	**United Kingdom (imported from Denmark)**	2007-2008	[138]
Chicken meat (free range farming)	30	5[*1]	--	2	--	--	--	--	--	--	--	5	--	5	2	--	--	**United Kingdom (imported from France)**	2007-2008	[138]
Chicken meat (conventional farming)	5	1[*1]	--	1	--	--	--	--	--	--	--	1	--	1	0	--	--	**United Kingdom (imported from France)**	2007-2008	[138]
Chicken meat (conventional farming)	23	3[*1]	--	1	--	--	--	--	--	--	--	0	--	0	0	--	--	**United Kingdom (imported from Republic of Ireland)**	2007-2008	[138]

Food items	Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS		3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLUORO)QUINOLONES			MACROLIDES			Country	Year	Reference
			% AMC	% AMP	% PEN	% AMX	% CEF	% FAM	% FOX	% CTX	% IPM	% CIP	% ENR	% NAL	% ERY	% CLR	% AZM			
Chicken meat (conventional farming)	44	3[*1]	--	63.6	--	--	--	--	--	--	--	63.6	--	72.7	36.4	--	--	**United Kingdom (imported from Poland)**	2007-2008	[138]
Chicken meat (conventional farming)	95	11	--	63.6	--	--	--	--	--	--	--	63.6	--	72.7	36.4	--	--	**United Kingdom (imported, country of origin unknown)**	2007-2008	[138]
Chicken meat (overall for all production systems)	N/S	52	--	--	--	--	--	--	--	--	--	55	--	55	11	--	--	**United Kingdom**	2014-2015	[139]
Chicken meat (free-range farming)	N/S	13	--	--	--	--	--	--	--	--	--	69.2	--	61.5	7.7	--	--	**United Kingdom**	2014-2015	[139]
Chicken meat (organic farming)	N/S	6[1]	--	--	--	--	--	--	--	--	--	5	--	5	1	--	--	**United Kingdom**	2014-2015	[139]
Chicken meat (conventional farming)	N/S	33	--	--	--	--	--	--	--	--	--	42.4	--	42.4	12.1	--	--	**United Kingdom**	2014-2015	[139]
Chicken meat	170	30	2	14	--	--	--	--	--	--	--	22	--	20	0	--	--	Austria	2012	[7]
Chicken meat	170	99	--	36.4	--	--	--	--	--	--	--	69.7	--	68.7	3	--	--	Austria	2013	[3]
Chicken meat	N/S	45	--	--	--	--	--	--	--	--	--	88.9	--	88.9	11.1	--	--	Austria	2014	[140]
Chicken meat	240	21	--	100	--	--	--	--	--	--	--	76.2	--	--	0	--	--	Czech Republic	2009	[141]
Chicken meat	52	52	--	--	--	--	--	--	--	--	--	65	--	65	12	--	--	Denmark	2004	[18]
Chicken meat	9	9[*1]	--	--	--	--	--	--	--	--	--	2	--	2	3	--	--	Denmark	2004	[18]
Chicken meat	N/S	5[*1]	--	--	--	--	--	--	--	--	--	2	--	2	0	--	--	Denmark	2005	[19]
Chicken meat	N/S	24	--	--	--	--	--	--	--	--	--	58	--	58	17	--	--	Denmark	2005	[19]

Food items	Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS		3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLUORO)QUINOLONES			MACROLIDES			Country	Year	Reference
			% AMC	% AMP	% PEN	% AMX	% CEF	% FAM	% FOX	% CTX	% IPM	% CIP	% ENR	% NAL	% ERY	% CLR	% AZM			
Chicken meat	170	20	--	--	--	--	--	--	--	--	--	0	--	0	0	--	--	Denmark	2010	[65]
Chicken meat	72	20	--	--	--	--	--	--	--	--	--	0	--	0	0	--	--	Denmark	2010	[64]
Chicken meat	95	27	--	--	--	--	--	--	--	--	--	85.2	--	85.2	14.8	--	--	Denmark	2010	[64]
Chicken meat	170	22	--	--	--	--	--	--	--	--	--	36.4	--	36.4	0	--	--	Denmark	2013	[3]
Chicken meat	22	22	--	--	--	--	--	--	--	--	--	36.4	--	36.4	0	--	--	Denmark	2013	[68]
Chicken meat	19	19	--	--	--	--	--	--	--	--	--	68.4	--	68.4	5.3	--	--	Denmark	2013	[68]
Chicken meat	170	7*1	--	--	--	--	--	--	--	--	--	5	--	3	0	--	--	Estonia	2012	[7]
Chicken meat	N/S	72	--	--	--	--	--	--	--	--	--	80.6	--	79.2	15.3	--	--	Germany	2014	[140]
Chicken meat	369	18	0	66.7	--	--	--	55.6	27.8	0	0	55.6	--	--	77.8	--	--	Greece	2005-2010	[142]
Chicken meat	170	33	--	--	--	--	--	--	--	--	--	90.2	--	--	3.3	--	--	Hungary	2011	[66]
Chicken meat	170	47	--	--	--	--	--	--	--	--	--	41	--	--	1	--	--	Hungary	2012	[7]
Chicken meat	155	56	--	--	--	--	100	--	--	--	--	78.6	78.6	78.6	25	--	25	Italy	2000	[143]
Chicken meat	104	23	--	39.1	--	--	82.6	--	--	39.1	--	60.9	60.9	19	43.5	--	--	Italy	N/S	[144]
Chicken meat	101	48	--	--	--	--	--	--	--	--	--	42	--	42	0	--	--	Poland	2009	[135]
Chicken meat	170	81	--	--	--	--	--	--	--	--	--	90	--	90	0	--	--	Poland	2010	[65]
Chicken meat	170	33	--	--	--	--	--	--	--	--	--	82.2	--	80.9	0.6	--	--	Poland	2011	[66]
Chicken meat	170	7*1	--	--	--	--	--	--	--	--	--	7	--	7	0	--	--	Poland	2012	[7]
Chicken meat	297	159	--	--	--	--	--	--	--	--	--	6.3	--	--	6.3	--	--	Poland	2006-2009	[145]
Chicken meat	161	108	--	--	--	--	--	--	--	--	--	97.2	--	--	9.3	--	--	Poland	2008-2009	[146]
Chicken meat	N/S	17	--	--	--	--	--	--	--	--	--	100	--	100	41.2	--	--	Portugal	2014	[140]
Chicken meat	170	81	--	--	--	--	--	--	--	--	--	67	--	65	26	--	--	Romania	2012	[7]

Food items	Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS		3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLUORO)QUINOLONES			MACROLIDES			Country	Year	Reference
			% AMC	% AMP	% PEN	% AMX	% CEF	% FAM	% FOX	% CTX	% IPM	% CIP	% ENR	% NAL	% ERY	% CLR	% AZM			
Chicken meat	170	11	--	--	--	--	--	--	--	--	--	9	--	9	2	--	--	Slovenia	2013	[3]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **AZM**- azithromycin; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CLR**- clarythromycin; **CTX**- cefotaxime; **ENR**- enrofloxacin; **ERY**- erythromycin; **IPM-** imipenem; **FAM-** cefamandole; **FOX-** cefoxitin; **NAL**- nalidixic acid; **PEN**- penicillin (generic)

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.86: UK & Europe- Antimicrobial resistance beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. coli* isolates from turkey meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES		MACROLIDES	Country	Year	Reference
		% AMP	% CIP	% NAL	% ERY			
214	5[*1]	3	--	--	80	**United Kingdom**	2003-2005	[134]
N/S	37	--	86.5	83.8	29.7	Germany	2014	[140]
170	11	--	10	--	0	Hungary	2012	[7]
170	3[*1]	--	3	2	1	Romania	2012	[7]

AMP- ampicillin; **CIP**- ciprofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid.

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.87: North, Central & South America- Antimicrobial resistance beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. coli* isolates from poultry meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES		MACROLIDES	Country	Year	References
		% AMP	% CIP	% NAL	% ERY			
60	7[*1]	3	7	7	1	Argentina	N/S	[147]
N/S	75	--	40	43	61	United States	1999-2000	[122]

AMP- ampicillin; **CIP**- ciprofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.88: North, Central & South America- Antimicrobial resistance beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. coli* isolates from chicken meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS		(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% CIP	% NAL	% AZM	% ERY			
N/S	13	--	--	0	0	31	31	Canada	2005	[97]
N/S	3[*1]	--	--	0	0	0	0	Canada	2005	[97]
N/S	14	--	--	0	0	7.1	7.1	Canada	2005	[97]
N/S	10	--	--	20	20	10	10	Canada	2007	[92]
N/S	14	--	--	43	43	29	29	Canada	2007	[92]
N/S	2[*1]	--	--	0	0	0	0	Canada	2007	[92]
N/S	17	--	--	5.9	5.9	0	0	Canada	2007	[92]
N/S	5[*1]	--	--	0	0	0	0	Canada	2008	[36]
N/S	16	--	--	6.3	6.3	19	19	Canada	2008	[36]
N/S	6[*1]	--	--	1	1	0	0	Canada	2008	[36]
N/S	3[*1]	--	--	0	0	0	0	Canada	2008	[36]
N/S	7[*1]	--	--	1	1	0	0	Canada	2009	[93]
N/S	7[*1]	--	--	0	0	1	1	Canada	2009	[93]
N/S	5[*1]	--	--	2	2	0	0	Canada	2009	[93]
N/S	4[*1]	--	--	0	0	0	0	Canada	2009	[93]

Number of food samples	Number of isolates	PENICILLINS		(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% CIP	% NAL	% AZM	% ERY			
N/S	11	--	--	27	27	0	0	Canada	2009	[93]
N/S	4[*1]	--	--	4	4	0	0	Canada	2010	[94]
N/S	6[*1]	--	--	1	4	0	0	Canada	2010	[94]
N/S	4[*1]	--	--	1	1	0	0	Canada	2010	[94]
N/S	4[*1]	--	--	0	0	1	1	Canada	2010	[94]
N/S	7[*1]	--	--	3	3	0	0	Canada	2012	[95]
N/S	3[*1]	--	--	0	0	0	0	Canada	2012	[95]
N/S	3[*1]	--	--	1	1	0	0	Canada	2012	[95]
N/S	10	--	--	10	10	20	20	Canada	2012	[95]
N/S	10	--	--	10	10	10	10	Canada	2013	[95]
N/S	3[*1]	--	--	0	0	0	0	Canada	2013	[95]
N/S	3[*1]	--	--	1	1	0	0	Canada	2013	[95]
N/S	4[*1]	--	--	2	2	0	0	Canada	2013	[95]
N/S	24	--	--	8.3	8.3	4.2	4.2	Canada	2006	[98]
N/S	11	--	--	0	0	9.1	9.1	Canada	2006	[98]
N/S	17	--	--	5.9	5.9	18	18	Canada	2006	[98]
1,256	65	0	7.7	3.1	3.1	--	12	Canada	2001-2004	[124]
113	10	--	--	10	--	--	--	United States	N/S	[148]

Number of food samples	Number of isolates	PENICILLINS		(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% CIP	% NAL	% AZM	% ERY			
237	65	--	--	22	--	--	34	United States	2001-2002	[149]
209	65	--	--	22	--	--	14	United States	2001-2002	[150]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AZM**- azithromycin; **CIP**- ciprofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.89: North, Central & South America- Antimicrobial resistance beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. coli* isolates from turkey meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)-QUINOLONES		MACROLIDES		Country	Year	References
		% AMP	% CIP	% NAL	% AZM	% ERY			
N/S	1[*1]	--	0	0	0	0	Canada	2012	[95]
N/S	8[*1]	--	0	0	1	1	Canada	2012	[95]
N/S	7[*1]	--	4	4	0	0	Canada	2012	[95]
465	36	10	6	6	--	4	Canada	2003-2004	[151]
227	11	--	82	--	--	46	United States	2001-2002	[149]
187	11	--	82	--	--	18	United States	2001-2002	[150]

AMP- ampicillin; **AZM**- azithromycin; **CIP**- ciprofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.90: Africa- Antimicrobial resistance beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. coli* isolates from poultry meat

Note: No data were available in eligible studies

Table 3.91: Asia- Antimicrobial resistance beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. coli* isolates from poultry meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS		(FLUORO)QUINOLONES			MACROLIDES		Country	Year	References
		% AMP	% AMX	% CIP	% ENR	% NAL	% AZM	% ERY			
152	40	--	0	7.5	--	15	0	0	Cambodia	2006-2007	[152]
300	27	7.4	3.7	56	26	67	--	0	Iran	2012	[153]
475	156	76	--	68	58	71	--	6.3	Korea, South	2004-2008	[154]
475	156	76	--	68	58	71	--	6.3	Korea, South	2004-2008	[154]
106[*1]	19	68.4	--	100	--	100	5.3	26.3	Korea, South	2013	[155]

AMP- ampicillin; **AMX**- amoxicillin; **AZM**- azithromycin; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid

[*1] Duck meat

Table 3.92: Asia- Antimicrobial resistance beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. coli* isolates from chicken meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS		1ST GEN CEPHALOSPORINS	3ND GEN CEPHALOSPORINS	CARBAPENEMS	(FLUORO)QUINOLONES			MACROLIDES			Country	Year	References
		% AMP	% AMX	% CEF	% CTX	% IPM	% CIP	% ENR	% NAL	% AZM	% CLR	% ERY			
128	32	--	--	--	--	--	100	--	--	--	--	97	China	2012	[156]
240	66	--	--	--	--	--	100	--	--	82	--	82	China	2012-2013	[157]
190	26	0	14	--	--	--	41	--	82	--	--	0	Iran	2006-2007	[158]
360	27	11	22	--	--	--	44	15	48	--	--	33	Iran	2013	[159]
170	45	49	--	96	--	--	67	--	71	--	--	29	Japan	N/S	[160]
100	3[*1]	0	--	--	0	0	1	--	--	--	--	0	Japan	2004-2006	[42]
54	7[*1]	0	--	--	--	--	--	2	2	--	--	0	Japan	2012	[161]
102	6[*1]	1	--	--	--	--	--	1	1	--	--	33	Japan	2012	[161]
18	1[*1]	--	--	--	--	--	--	0	--	--	--	--	Japan	N/S	[162]
41	1[*1]	--	--	--	--	--	--	1	--	--	--	--	Japan	N/S	[162]
34	4[*1]	--	--	--	--	--	--	4	--	--	--	--	Japan	N/S	[162]
69	9[*1]	5	--	--	--	--	2	2	2	--	--	0	Korea, South	2004-2008	[154]
69	5[*1]	3	--	--	--	--	3	3	3	--	--	1	Korea, South	2004-2008	[154]

Number of food samples	Number of isolates	PENICILLINS		1ST GEN CEPHALOSPORINS	3ND GEN CEPHALOSPORINS	CARBAPENEMS	(FLUORO)QUINOLONES			MACROLIDES			Country	Year	References
		% AMP	% AMX	% CEF	% CTX	% IPM	% CIP	% ENR	% NAL	% AZM	% CLR	% ERY			
39	3[*1]	3	--	--	--	--	3	3	3	--	--	0	Korea, South	2004-2008	[154]
96	8[*1]	1	--	--	--	--	1	1	1	--	--	0	Korea, South	2004-2008	[154]
516	12	25	--	--	--	--	17	8.3	25	--	--	8.3	Korea, South	2004-2008	[154]
78	7[*1]	6	--	--	--	--	6	6	6	--	--	1	Korea, South	2004-2008	[154]
69	9[*1]	5	--	--	--	--	2	2	2	--	--	0	Korea, South	2004-2008	[154]
69	5[*1]	3	--	--	--	--	3	3	3	--	--	1	Korea, South	2004-2008	[154]
39	3[*1]	3	--	--	--	--	3	3	3	--	--	0	Korea, South	2004-2008	[154]
96	8[*1]	1	--	--	--	--	1	1	1	--	--	0	Korea, South	2004-2008	[154]
516	12	25	--	--	--	--	17	8.3	25	--	--	8.3	Korea, South	2004-2008	[154]
78	7[*1]	6	--	--	--	--	6	6	6	--	--	14	Korea, South	2004-2008	[154]
80	5[*1]	5	--	--	--	--	4	--	4	0	--	0	Korea, South	2013	[155]
120	23	60	--	--	--	--	52	--	--	--	--	32	Philippines	2013	[163]

AMP- ampicillin; **AMX**- amoxicillin; **AZM**- azithromycin; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CLR**- clarythromycin; **CTX**- cefotaxime; **ENR**- enrofloxacin; **ERY**- erythromycin; **IPM-** imipenem; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Campylobacter jejuni

Table 3.93: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. jejuni* isolates from poultry meat

Note: resistance to polymyxins was not explored in eligible studies.

number of food samples	Number of isolates	PENICILLINS			(FLURO)QUINOLONES			MACROLIDES		Country	Year	References
		% AMC	% AMP	% AMX	% CIP	% ENR	% NAL	% CLR	% ERY			
77	9[*1]	--	6	--	--	--	--	--	0	**United Kingdom**	2003-2005	[134]
35	3[*1]	--	2	--	--	--	--	--	0	**United Kingdom**	2003-2005	[134]
31	31	--	--	--	39	--	42	--	0	Denmark	1999	[61]
100	100	--	--	--	12	--	12	--	1	Denmark	1999-2003	[164]
584	103	--	--	--	3	--	3	--	0	Denmark	2004	[28]
300	122	--	16.4	3.3	87.7	9	74.6	--	0.8	Iran	2012	[153]
113	14	35.7	64.3	--	64.3	--	71.4	--	71.4	Italy	2012	[119]
N/S	54	--	70.4	--	57.4	--	61.1	3.7	3.7	The Netherlands	2013	[88]
N/S	145	--	--	--	63.4	--	63.4	--	0.7	The Netherlands	2014	[74]
N/S	254	--	53.5	--	58.7	--	58.7	1.6	1.6	NeThe therlands	2010-2011	[73]
368	122	--	--	--	91	--	89.3	--	0	Poland	2009-2011	[135]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **CIP**- ciprofloxacin; **CLR**- clarythromycin; **CRO**- ceftriaxone; **ENR**- enrofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid.

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.94: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. jejuni* isolates from chicken meat

Note: resistance to polymyxins was not explored in eligible studies.

Food items	number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLURO)QUINOLONES			MACROLIDES		Country	Year	References
			% AMC	% AMP	% PEN	% CEF	% CXM	% CRO	% FAM	% FOX	% CTX	% IPM	% CIP	% ENR	% NAL	% AZM	% ERY			
Chicken meat	150	33	--	--	100	--	--	--	--	--	--	--	18.2	--	18.2	--	3	**United Kingdom**	1995-2000	[115]
Chicken meat	412	141	--	--	100	--	--	--	--	--	--	--	8.5	--	6.4	--	5	**United Kingdom**	1995-2001	[115]
Chicken meat	N/S	576	--	--	--	--	--	--	--	--	--	--	22	--	22	--	2.5	**United Kingdom**	2001	[136]
Chicken meat (conventional farming)	151	25	--	4	--	--	--	--	--	--	--	--	12	--	12	--	0	**United Kingdom (imported from the Netherlands)**	2001	[137]
Chicken meat (conventional farming)	56	30	--	10	--	--	--	--	--	--	--	--	13.3	--	13.3	--	0	**United Kingdom (imported from the Republic of Ireland)**	2001	[137]
Chicken meat (conventional farming)	23	1[*1]	--	1	--	--	--	--	--	--	--	--	1	--	1	--	0	**United Kingdom (imported from Thailand)**	2001	[137]
Chicken meat (conventional farming)	3,882	1,046	--	37	--	--	--	--	--	--	--	--	12.6	--	15.6	--	0.2	**United Kingdom**	2001	[137]
Chicken meat (free range farming)	147	32	--	31.3	--	--	--	--	--	--	--	--	3.1	--	9.4	--	0	**United Kingdom**	2001	[137]

Food items	number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLURO)QUINOLONES			MACROLIDES		Country	Year	References
			% AMC	% AMP	% PEN	% CEF	% CXM	% CRO	% FAM	% FOX	% CTX	% IPM	% CIP	% ENR	% NAL	% AZM	% ERY			
Chicken meat (organic farming)	44	9[*1]	--	4	--	--	--	--	--	--	--	--	2	--	2	--	0	**United Kingdom**	2001	[137]
Chicken meat	1,778	64	--	57.8	--	--	--	--	--	--	--	--	--	--	--	--	1.5	**United Kingdom**	2003-2005	[134]
Chicken meat (organic farming)	28	3[*1]	--	1	--	--	--	--	--	--	--	--	0	--	0	--	0	**United Kingdom**	2007-2008	[138]
Chicken meat (free range farming)	156	7[*1]	--	6	--	--	--	--	--	--	--	--	1	--	1	--	0	**United Kingdom**	2007-2008	[138]
Chicken meat (conventional farming)	2,573	529	--	83.2	--	--	--	--	--	--	--	--	21.7	--	23.1	--	4.2	**United Kingdom**	2007-2008	[138]
Chicken meat (conventional farming)	56	1[*1]	--	0	--	--	--	--	--	--	--	--	0	--	0	--	0	**United Kingdom (imported from Brazil)**	2007-2008	[138]
Chicken meat (conventional farming)	176	15	--	66.7	--	--	--	--	--	--	--	--	0	--	0	--	6.7	**United Kingdom (imported from Denmark)**	2007-2008	[138]
Chicken meat (conventional farming)	44	2[*1]	--	1	--	--	--	--	--	--	--	--	1	--	1	--	0	**United Kingdom (imported from EU, country unknown)**	2007-2008	[138]

Food items	number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLURO)QUINOLONES			MACROLIDES		Country	Year	References
			% AMC	% AMP	% PEN	% CEF	% CXM	% CRO	% FAM	% FOX	% CTX	% IPM	% CIP	% ENR	% NAL	% AZM	% ERY			
Chicken meat (conventional farming)	30	2[*1]	--	2	--	--	--	--	--	--	--	--	0	--	0	--	0	**United Kingdom (imported from France)**	2007-2008	[138]
Chicken meat (conventional farming)	23	2[*1]	--	2	--	--	--	--	--	--	--	--	0	--	0	--	0	**United Kingdom (imported from the Republic of Ireland)**	2007-2008	[138]
Chicken meat (conventional farming)	96	6[*1]	--	2	--	--	--	--	--	--	--	--	0	--	0	--	0	**United Kingdom (imported, country of origin unknown)**	2007-2008	[138]
Chicken meat (conventional farming)	44	7[*1]	--	4	--	--	--	--	--	--	--	--	3	--	4	--	2	**United Kingdom (imported from Poland)**	2007-2008	[138]
Chicken meat (all production systems combined)	N/S	230	--	--	--	--	--	--	--	--	--	--	49	--	51	--	0.9	**United Kingdom**	2014-2015	[139]
Chicken meat (free-range farming)	N/S	27	--	--	--	--	--	--	--	--	--	--	40.7	--	48.1	--	0	**United Kingdom**	2014-2015	[139]
Chicken meat (organic farming)	N/S	5[*1]	--	--	--	--	--	--	--	--	--	--	3	--	3	--	0	**United Kingdom**	2014-2015	[139]

Food items	number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLURO)QUINOLONES			MACROLIDES		Country	Year	References
			% AMC	% AMP	% PEN	% CEF	% CXM	% CRO	% FAM	% FOX	% CTX	% IPM	% CIP	% ENR	% NAL	% AZM	% ERY			
Chicken meat (conventional farming)	N/S	198	--	--	--	--	--	--	--	--	--	--	50	--	51.5	--	1	**United Kingdom**	2014-2015	[139]
Chicken meat	170	60	0	19	--	--	--	--	--	--	--	--	38	--	4	--	0	Austria	2012	[7]
Chicken meat	170	144	--	30.6	--	--	--	--	--	--	--	--	71.5	--	68.8	--	0	Austria	2013	[3]
Chicken meat	N/S	102	--	--	--	--	--	--	--	--	--	--	71.6	--	67.6	--	0	Austria	2014	[140]
Chicken meat	135	145	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	Belgium	2007	[165]
Chicken meat	240	67	--	58.2	--	--	--	--	--	--	--	--	53.7	--	--	--	1.5	Czech Republic	2009	[141]
Chicken meat	65	65	--	--	--	--	--	--	--	--	--	--	8	--	20	--	--	Denmark	1999	[61]
Chicken meat	24	24	--	--	--	--	--	--	--	--	--	--	17	--	21	--	--	Denmark	1999	[61]
Chicken meat	13	13	--	--	--	--	--	--	--	--	--	--	0	--	0	--	0	Denmark	2001	[15]
Chicken meat	61	61	--	--	--	--	--	--	--	--	--	--	13	--	13	--	2	Denmark	2001	[15]
Chicken meat	70	70	--	--	--	--	--	--	--	--	--	--	3	--	3	--	0	Denmark	2002	[16]
Chicken meat	29	29	--	--	--	--	--	--	--	--	--	--	14	--	14	--	0	Denmark	2002	[16]
Chicken meat	12	12	--	--	--	--	--	--	--	--	--	--	8	--	8	--	0	Denmark	2003	[17]
Chicken meat	77	77	--	--	--	--	--	--	--	--	--	--	1	--	1	--	0	Denmark	2003	[17]
Chicken meat	103	103	--	--	--	--	--	--	--	--	--	--	3	--	3	--	0	Denmark	2004	[18]

Food items	number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLURO)QUINOLONES			MACROLIDES		Country	Year	References
			% AMC	% AMP	% PEN	% CEF	% CXM	% CRO	% FAM	% FOX	% CTX	% IPM	% CIP	% ENR	% NAL	% AZM	% ERY			
Chicken meat	101	101	--	--	--	--	--	--	--	--	--	--	48	--	48	--	3	Denmark	2004	[18]
Chicken meat	N/S	86	--	--	--	--	--	--	--	--	--	--	41	--	41	--	2	Denmark	2005	[19]
Chicken meat	N/S	76	--	--	--	--	--	--	--	--	--	--	5	--	5	--	1	Denmark	2005	[19]
Chicken meat	137	137	--	--	--	--	--	--	--	--	--	--	42	--	42	--	1	Denmark	2007	[21]
Chicken meat	114	114	--	--	--	--	--	--	--	--	--	--	11	--	11	--	2	Denmark	2007	[21]
Chicken meat	26	26	--	--	--	--	--	--	--	--	--	--	19	--	19	--	0	Denmark	2008	[62]
Chicken meat	152	152	--	--	--	--	--	--	--	--	--	--	53	--	53	--	7	Denmark	2008	[62]
Chicken meat	246	26	--	--	--	--	--	--	--	--	--	--	0	--	0	--	0	Denmark	2009	[63]
Chicken meat	159	62	--	--	--	--	--	--	--	--	--	--	56	--	56	--	0	Denmark	2009	[63]
Chicken meat	170	52	--	--	--	--	--	--	--	--	--	--	17	--	14	--	2	Denmark	2010	[65]
Chicken meat	72	52	--	--	--	--	--	--	--	--	--	--	17	--	13	--	2	Denmark	2010	[64]
Chicken meat	95	68	--	--	--	--	--	--	--	--	--	--	50	--	50	--	4	Denmark	2010	[64]
Chicken meat	170	33	--	--	--	--	--	--	--	--	--	--	11.5	--	11.5	--	0	Denmark	2011	[66]
Chicken meat	70	70	--	--	--	--	--	--	--	--	--	--	57	--	57	--	6	Denmark	2011	[64]
Chicken meat	61	61	--	--	--	--	--	--	--	--	--	--	11	--	11	--	0	Denmark	2011	[64]
Chicken meat	170	66	--	--	--	--	--	--	--	--	--	--	19	--	19	--	0	Denmark	2012	[7]
Chicken meat	66	66	--	--	--	--	--	--	--	--	--	--	29	--	29	--	0	Denmark	2012	[67]

Food items	number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLURO)QUINOLONES			MACROLIDES		Country	Year	References
			% AMC	% AMP	% PEN	% CEF	% CXM	% CRO	% FAM	% FOX	% CTX	% IPM	% CIP	% ENR	% NAL	% AZM	% ERY			
Chicken meat	26	26	--	--	--	--	--	--	--	--	--	--	46	--	46	--	4	Denmark	2012	[67]
Chicken meat	170	70	--	--	--	--	--	--	--	--	--	--	20	--	20	--	0	Denmark	2013	[3]
Chicken meat	30	30	--	--	--	--	--	--	--	--	--	--	53	--	57	--	0	Denmark	2013	[68]
Chicken meat	70	70	--	--	--	--	--	--	--	--	--	--	20	--	20	--	0	Denmark	2013	[68]
Chicken meat	207	207	--	--	--	--	--	--	--	--	--	--	12	--	11.5	--	3	Denmark	1996-1998	[164]
Chicken meat	460	460	--	--	--	--	--	--	--	--	--	--	7.4	--	7.4	--	0.7	Denmark	1999-2003	[164]
Chicken meat	367	367	--	--	--	--	--	--	--	--	--	--	6	--	6	--	0.8	Denmark	1999-2003	[164]
Chicken meat	88	88	--	--	--	--	--	--	--	--	--	--	12.5	--	12.5	--	0	Denmark	1999-2003	[164]
Chicken meat	N/S	26	--	--	--	--	--	--	--	--	--	--	15.4	--	15.4	--	0	Denmark	2014	[140]
Chicken meat	170	3*1	--	--	--	--	--	--	--	--	--	--	2	--	2	--	0	Estonia	2012	[115]
Chicken meat	170	19	--	--	--	--	--	--	--	--	--	--	12	--	0	--	1	Estonia	2012	[115]
Chicken meat	361	97	--	--	--	--	--	--	--	--	--	--	32.9	--	32	--	0	France	2009	[166]
Chicken meat	N/S	180	--	--	--	--	--	--	--	--	--	--	69.4	--	65	--	3.3	Germany	2014	[140]
Chicken meat	19	3*1	0	3	--	--	2	0	--	--	--	0	0	--	--	--	--	Greece	2004-2007	[81]
Chicken meat	369	23	0	65.2	--	--	--	--	30.4	26.1	8.7	0	47.8	--	--	--	73.9	Greece	2005-2010	[142]
Chicken meat	170	33	--	--	--	--	--	--	--	--	--	--	84.8	--	--	--	0	Hungary	2011	[66]
Chicken meat	170	22	--	--	--	--	--	--	--	--	--	--	18	--	--	--	0	Hungary	2012	[7]

Food items	number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLURO)QUINOLONES			MACROLIDES		Country	Year	References
			% AMC	% AMP	% PEN	% CEF	% CXM	% CRO	% FAM	% FOX	% CTX	% IPM	% CIP	% ENR	% NAL	% AZM	% ERY			
Chicken meat	155	72	--	--	--	100	--	--	--	--	--	--	52.8	52.8	59.7	12.5	12.5	Italy	2000	[143]
Chicken meat	104	30	--	43.3	--	76.7	--	--	--	--	26.7	--	53.3	53.3	80	--	30	Italy	N/S	[144]
Chicken meat	100	35	--	6.7	--	--	--	--	--	--	--	--	--	1.9	1.9	--	0	Norway	2005	[167]
Chicken meat	101	40	--	--	--	--	--	--	--	--	--	--	32	--	31	--	0	Poland	2009	[135]
Chicken meat	170	46	--	--	--	--	--	--	--	--	--	--	83	--	80	--	0	Poland	2010	[65]
Chicken meat	170	33	--	--	--	--	--	--	--	--	--	--	90.2	--	89.7	--	0	Poland	2011	[66]
Chicken meat	170	23	--	--	--	--	--	--	--	--	--	--	23	--	22	--	0	Poland	2012	[7]
Chicken meat	130	60	--	3	--	--	--	--	--	--	--	--	3	--	--	--	--	Poland	2003-2005	[168]
Chicken meat	297	52	--	--	--	--	--	--	--	--	--	--	0	--	--	--	0	Poland	2006-2009	[145]
Chicken meat	161	35	--	--	--	--	--	--	--	--	--	--	100	--	--	--	11.4	Poland	2008-2009	[146]
Chicken meat	170	64	--	--	--	--	--	--	--	--	--	--	52	--	53	--	9	Romania	2012	[7]
Chicken meat	170	60	--	--	--	--	--	--	--	--	--	--	78	--	50	--	0	Slovenia	2010	[65]
Chicken meat	170	25	--	--	--	--	--	--	--	--	--	--	18	--	16	--	0	Slovenia	2013	[3]
Chicken meat	158	129	--	--	--	--	--	--	--	--	--	--	87	--	--	--	12	Slovenia	2002-2003, 2008-2009	[121]
Chicken meat	170	12	--	--	--	--	--	--	--	--	--	--	50	--	50	--	0	Sweden	2013	[3]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AZM**- azithromycin; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **CTX**- cefotaxime; **CXM**- cefuroxime; **ENR**- enrofloxacin; **ERY**- erythromycin; **FAM-** cefamandole; **FOX-** cefoxitin; **IPM-** imipenem; **NAL**- nalidixic acid; **PEN**- penicillin (generic)

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below or equal to 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.95: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. jejuni* isolates from turkey meat

Note: resistance to polymyxins was not explored in eligible studies.

number of food samples	Number of isolates	PENICILLINS	(FLURO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMP	% CIP	% NAL	% AZM	% ERY			
214	6[*1]	4	--	--	--	1	**United Kingdom**	2003-2005	[134]
N/S	13	--	92.3	84.6	--	0	Austria	2014	[140]
25	25	--	0	0	--	0	Denmark	2001	[15]
18	18	--	0	0	--	6	Denmark	2001	[15]
42	42	--	60	57	--	7	Denmark	2007	[21]
N/S	61	--	60.7	54.1	--	0	Germany	2014	[140]
170	9[*1]	--	5	--	--	0	Hungary	2012	[7]
170	2[*1]	--	2	1	--	0	Romania	2012	[7]
170	4[*1]	--	2	1	--	--	Slovenia	2010	[65]
270	41	--	17.4	9.2	95.4	94.5	Turkey	2007-2008	[169]

AMP- ampicillin; **AZM**- azithromycin; **CIP**- ciprofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.96: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. jejuni* isolates from poultry meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES			MACROLIDES	Country	Year	References
		% AMP	% CIP	% ENR	% NAL	% ERY			
60	15	60	100	66.7	86.7	20	Argentina	N/S	[147]
N/S	88	--	25	--	32	42	United States	1999-2000	[122]

AMP- ampicillin; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid

Table 3.97: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. jejuni* isolates from chicken meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS			(FLUORO)QUINOLONES			MACROLIDES		Country	Year	References
		% AMC	% AMP	% AMX	% CIP	% ENR	% NAL	% ERY	% AZM			
92	16	--	--	87.5	100	--	93.8	68.8	--	Brazil	2009	[170]
420	55	--	--	61.8	--	--	--	25.5	--	Brazil	N/S	[171]
N/S	86	--	--	--	0	--	0	14	14	Canada	2005	[97]
N/S	42	--	--	--	0	--	0	0	0	Canada	2005	[97]
N/S	100	--	--	--	0	--	0	1	1	Canada	2005	[97]

Number of food samples	Number of isolates	PENICILLINS			(FLUORO)QUINOLONES			MACROLIDES		Country	Year	References
		% AMC	% AMP	% AMX	% CIP	% ENR	% NAL	% ERY	% AZM			
N/S	87	--	--	--	2.3	--	2.3	1.1	1.1	Canada	2006	[98]
N/S	75	--	--	--	0	--	0	9.3	10.7	Canada	2006	[98]
N/S	40	--	--	--	2.5	--	2.5	0	0	Canada	2006	[98]
N/S	39	--	--	--	2.6	--	2.6	0	0	Canada	2007	[92]
N/S	97	--	--	--	0	--	0	2.1	2.1	Canada	2007	[92]
N/S	44	--	--	--	4.5	--	4.5	4.5	4.5	Canada	2007	[92]
N/S	26	--	--	--	3.8	--	3.8	0	0	Canada	2007	[92]
N/S	49	--	--	--	0	--	0	12.2	12.2	Canada	2008	[36]
N/S	104	--	--	--	3.8	--	3.8	6.7	6.7	Canada	2008	[36]
N/S	44	--	--	--	6.8	--	6.8	0	0	Canada	2008	[36]
N/S	37	--	--	--	10.8	--	10.8	0	0	Canada	2008	[36]
N/S	48	--	--	--	0	--	0	8.3	8.3	Canada	2009	[93]
N/S	65	--	--	--	27.7	--	27.7	0	0	Canada	2009	[93]
N/S	41	--	--	--	14.6	--	14.6	0	0	Canada	2009	[93]
N/S	42	--	--	--	0	--	0	7.1	7.1	Canada	2009	[93]
N/S	94	--	--	--	1.1	--	1.1	4.3	4.3	Canada	2009	[93]
N/S	63	--	--	--	1.6	--	1.6	0	0	Canada	2010	[94]
N/S	58	--	--	--	0	--	0	1.7	1.7	Canada	2010	[94]
N/S	58	--	--	--	3.4	--	5.2	10.3	10.3	Canada	2010	[94]
N/S	34	--	--	--	8.8	--	8.8	2.9	2.9	Canada	2010	[94]

Number of food samples	Number of isolates	PENICILLINS			(FLUORO)QUINOLONES			MACROLIDES		Country	Year	References
		% AMC	% AMP	% AMX	% CIP	% ENR	% NAL	% ERY	% AZM			
N/S	62	--	--	--	14.5	--	16.1	3.2	3.2	Canada	2010	[94]
N/S	76	--	--	--	1.3	--	1.3	7.9	7.9	Canada	2012	[95]
N/S	75	--	--	--	13.3	--	13.3	5.3	5.3	Canada	2012	[95]
N/S	66	--	--	--	4.5	--	4.5	0	0	Canada	2012	[95]
N/S	36	--	--	--	5.6	--	5.6	2.8	2.8	Canada	2012	[95]
N/S	22	--	--	--	6.7	--	6.7	3.3	3.3	Canada	2013	[126]
N/S	48	--	--	--	6	--	6	0	0	Canada	2013	[126]
N/S	49	--	--	--	2	--	2	5.9	5.9	Canada	2013	[126]
N/S	69	--	--	--	5.8	--	5.8	3.8	3.8	Canada	2013	[126]
N/S	56	--	--	--	1.8	--	--	16	--	Canada	2000-2003	[172]
1,256	677	0	7.1	--	0.9	--	0.9	2.5	--	Canada	2001-2004	[124]
N/S	55	--	--	--	58.2	--	--	1.8	--	Chile	2006-2010	[173]
N/S	198	--	--	--	34	--	--	0	--	United States	2002	[14]
N/S	325	--	--	--	48	--	--	0	--	United States	2003	[14]
N/S	510	--	--	--	77	--	78	4	9	United States	2004	[14]
N/S	403	--	--	--	61	--	61	2	2	United States	2005	[14]
N/S	426	--	--	--	71	--	71	4	4	United States	2006	[14]
N/S	332	--	--	--	57	--	57	2	2	United States	2007	[14]
141	69	--	--	--	10	--	--	30	--	United States	2007	[132]
53	41	--	--	--	0	--	--	12	--	United States	2007	[132]

Number of food samples	Number of isolates	PENICILLINS			(FLUORO)QUINOLONES			MACROLIDES		Country	Year	References
		% AMC	% AMP	% AMX	% CIP	% ENR	% NAL	% ERY	% AZM			
N/S	329	--	--	--	48	--	48	4	4	United States	2008	[14]
N/S	404	--	--	--	86	--	86	4	4	United States	2009	[14]
N/S	355	--	--	--	80	--	81	2	2	United States	2010	[14]
N/S	393	--	--	--	89	--	85	2	2	United States	2011	[14]
N/S	421	--	--	--	69	--	69	3	5	United States	2012	[14]
N/S	428	--	--	--	48	--	48	7	7	United States	2013	[14]
209	110	--	--	--	19	--	--	0	--	United States	2001-2002	[150]
113	13	--	--	--	0	--	--	--	--	United States	N/S	[148]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **AZM**- azithromycin; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid

Table 3.98: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. jejuni* isolates from turkey meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS			(FLUORO)QUINOLONES			MACROLIDES		Country	Year	References
		% AMC	% AMP	% AMX	% CIP	% ENR	% NAL	% ERY	% AZM			
128	6[*1]	--	--	--	16.7	--	16.7	0	0	Canada	2012	[95]
N/S	26	--	--	--	11.5	--	11.5	0	0	Canada	2012	[95]
N/S	14	--	--	--	0	--	0	0	0	Canada	2012	[95]
N/S	12	--	--	--	0	--	0	8.3	8.3	Canada (Quebec)	2012	[95]
N/S	16	--	--	--	6.7	--	6.7	3.3	3.3	Canada	2013	[126]
N/S	19	--	--	--	5.8	--	5.8	3.8	3.8	Canada	2013	[126]

Number of food samples	Number of isolates	PENICILLINS			(FLUORO)QUINOLONES			MACROLIDES		Country	Year	References
		% AMC	% AMP	% AMX	% CIP	% ENR	% NAL	% ERY	% AZM			
N/S	12	--	--	--	2	--	2	5.9	5.9	Canada	2013	[126]
N/S	19	--	--	--	6	--	6	0	0	Canada	2013	[126]
465	171	--	35	--	5	--	6	1	--	Canada	2003-2004	[151]
N/S	2[*1]	--	--	--	1	--	--	0	--	United States	2002	[14]
N/S	4[*1]	--	--	--	0	--	--	0	--	United States	2003	[14]
N/S	7[*1]	--	--	--	2	--	2	0	0	United States	2004	[14]
N/S	10	--	--	--	1	--	1	0	0	United States	2005	[14]
N/S	12	--	--	--	6	--	6	0	0	United States	2006	[14]
N/S	20	--	--	--	6	--	6	1	1	United States	2007	[14]
N/S	10	--	--	--	6	--	6	1	1	United States	2008	[14]
N/S	9[*1]	--	--	--	4	--	4	0	0	United States	2009	[14]
N/S	5[*1]	--	--	--	2	--	2	0	0	United States	2010	[14]
N/S	13	--	--	--	6	--	6	0	0	United States	2011	[14]
N/S	3[*1]	--	--	--	1	--	1	0	0	United States	2012	[14]
N/S	7[*1]	--	--	--	1	--	1	0	0	United States	2013	[14]
187	4[*1]	--	--	--	0	--	--	0	--	United States	2001-2002	[150]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **AZM**- azithromycin; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below or equal to10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.99: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. jejuni* isolates from poultry meat

Note: No data were available in eligible studies

Table 3.100: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. jejuni* isolates from poultry meat

Note- resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS		(FLURO)QUINOLONES			MACROLIDES		Country	Year	References
		% AMP	% AMX	% CIP	% ENR	% NAL	% AZM	% ERY			
152	69	--	13	20.3	--	69.6	1.4	2.9	Cambodia	2006-2007	[152]
106	82	69.5	--	87.8	--	92.7	0.061	4.9	Korea, South	2013	[155]
475	219	54.8	--	91.3	82.2	96.8	--	7.3	Korea, South	2004-2008	[154]

AMP- ampicillin; **AMX**- amoxicillin; **AZM**- azithromycin; **CEF**- cephalothin; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.101: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. jejuni* isolates from chicken meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS		1ST GEN CEPHALOSPOINS	3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLURO)QUINOLONES			MACROLIDES		Country	Year	References
		% AMP	% AMX	% CEF	% CTX	% IPM	% CIP	% ENR	% NAL	% AZM	% ERY			
128	14	--	--	--	--	--	100	--	--	--	7.1	China	2012	[156]
240	85	--	--	--	--	--	96	--	--	13	12	China	2012-2013	[157]
360	200	6.5	13	--	--	--	84	30	66	--	38	Iran	2013	[159]
190	70	7.2	25.7	--	--	--	49	--	67.1	--	1.4	Iran	2006-2007	[158]
100	60	5	--	--	0	0	23.3	--	--	--	0	Japan	2004-2006	[42]
54	18	11.1	--	--	--	--	--	55.6	55.6	--	0	Japan	2012	[161]
102	33	9.1	--	--	--	--	--	27.3	24.2	--	0	Japan	2012	[161]
170	150	36	--	87.3	--	--	47.3	--	59.3	--	15.3	Japan	N/S	[160]
15	13	--	--	--	--	--	--	69.2	--	--	--	Japan	N/S	[162]
18	14	--	--	--	--	--	--	64.3	--	--	--	Japan	N/S	[162]
34	10	--	--	--	--	--	--	60	--	--	--	Japan	N/S	[162]
41	7[*1]	--	--	--	--	--	--	2	--	--	--	Japan	N/S	[162]
265	116	43.1	--	--	--	--	92.2	--	92.2	--	0	Korea, South	2004	[174]
80	42	52.4	--	--	--	--	83.3	--	92.9	19	16.7	Korea, South	2013	[155]
516	72	40.3	--	--	--	--	12.5	12.5	12.5	--	4.2	Korea, South	2004-2008	[154]
39	5[*1]	4	--	--	--	--	4	4	4	--	0	Korea, South	2004-2008	[154]
69	10	9	--	--	--	--	1	1	1	--	0	Korea, South	2004-2008	[154]
69	15	86.7	--	--	--	--	20	20	20	--	6.7	Korea, South	2004-2008	[154]
78	39	92.3	--	--	--	--	56.4	56.4	56.4	--	33.3	Korea, South	2004-2008	[154]

Number of food samples	Number of isolates	PENICILLINS		1ST GEN CEPHALOSPOINS	3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLURO)QUINOLONES			MACROLIDES		Country	Year	References
		% AMP	% AMX	% CEF	% CTX	% IPM	% CIP	% ENR	% NAL	% AZM	% ERY			
96	32	71.9	--	--	--	--	21.9	21.9	21.9	--	6	Korea, South	2004-2008	[154]
120	21	95	--	--	--	--	90	--	--	--	8	Philippines	2013	[163]

AMP- ampicillin; **AMX**- amoxicillin; **AZM**- azithromycin; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CTX**- cefotaxime; **ENR**- enrofloxacin; **ERY**- erythromycin; **IPM-** imipenem; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.102: Oceania- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. jejuni* isolates from chicken meat

Note: resistance to beta-lactams and polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	(FLURO)QUINOLONES			MACROLIDES		Country	Year	References
		% CIP	% ENR	% NAL	% AZM	% ERY			
N/S	26	0	--	0	--	0	Australia	2011	[175]

AZM- azithromycin; **CEF**- cephalothin; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid

Campylobacter lari

Table 3.103: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. lari* isolates from chicken meat

Note: resistance to polymyxins was not explored in eligible studies.

Food item	Number of food samples	Number of isolates	PENICILLINS		(FLUORO)QUINOLONES		MACROLIDES	Country	Year	References
			% AMP	% PEN	% CIP	% NAL	% ERY			
Chicken meat	412	3[*1]	--	3	1	3	0	**United Kingdom**	1995-2001	[115]
Chicken meat (conventional farming)	2,573	2[*1]	1	--	2	2	0	**United Kingdom**	2007-2008	[138]

CIP- ciprofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid; **PEN**- penicillin (generic)

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.104: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. lari* isolates from chicken meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS		(FLUORO)-QUINOLONES		MACROLIDES	Country	Year	References
		% AMC	% AMP	% CIP	% NAL	% ERY			
1,256	7[^1]	0	2	6	6	0	Canada	2001-2004	[124]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CIP**- ciprofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.105: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. lari* isolates from chicken meat

Note: No data was available in eligible studies

Table 3.106: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *C. lari* isolates from chicken meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMX	% CIP	% NAL	% AZM	% ERY			
152	30	20	63.3	90	13.3	13.35	Cambodia	2006-2007	[152]

AMX- amoxicillin; **AZM**- azithromycin; **CIP**- ciprofloxacin; **ERY**- erythromycin; **NAL**- nalidixic acid

***Campylobacter* spp**

Table 3.107: UK & Europe- MDR phenotypes observed in *Campylobacter* spp. isolates from poultry meat

Note: No data were available for the UK in eligible studies

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
46	2	CIP, GEN, NAL, STR, TET (n=1); CIP, GEN, NAL, STR (n=1)	Lithuania	2012	[118]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.108: UK & Europe- MDR phenotypes observed in *Campylobacter* spp. isolates from chicken meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
1	1	CIP, NAL, STR, TET, TMP	**United Kingdom**	2014-2015	[139]
36	5	CIP, GEN, NAL, STR,TET (n= 1); CIP, GEN, NAL, STR (n= 1); CIP, NAL, STR, TET (n= 3)	Estonia	2012	[118]
46	3	CIP, NAL, STR, TET	Lithuania	2012	[118]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.109: North, Central & South America- MDR phenotypes observed in *Campylobacter* spp. isolates from chicken meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
94	1	AZM, CIP, CLI, ERY, GEN, NAL, TET	Canada	2003	[35]
140	1	AZM, CIP, ERY, NAL, TET	Canada	2004	[96]
275	14	AZM, CLI ERY, TET	Canada	2005	[97]
264	N/S	AZM, CIP, CLI, ERY, NAL, TEL, TET	Canada	2008	[36]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.110: Africa- MDR phenotypes observed in *Campylobacter* spp. isolates from poultry meat

Note: No data were available in eligible studies

Table 3.111: Asia- MDR phenotypes observed in *Campylobacter* spp. isolates from poultry meat

Note: No data were available in eligible studies

MDR phenotypes in *Campylobacter coli*

Table 3.112: UK & Europe- MDR phenotypes observed in *C. coli* isolates from poultry meat

Note: No data were available for the UK in eligible studies

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
180	49	CIP, STR, TET (n=1); CIP, NAL, STR, TET (n=47); CIP, NAL, STR, TET, ERY (n=1)	Poland	2009-2011	[135]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.113: UK & Europe- MDR phenotypes observed in *C. coli* isolates from chicken meat

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Chicken meat (conventional farming)	330	24	AMP, CHL, NAL, ERY (n= 1); AMP, GEN, KAN, TET, NAL, CIP (n= 1); AMP, KAN, TET, NEO (n= 2); AMP, KAN, TET, NAL, CIP, NEO (n= 1); AMP, NAL, ERY (n= 1); AMP, TET, NAL (n= 1); AMP, TET, NAL, CIP (n= 10); GEN, KAN, TET, NAL, CIP, ERY, NEO (n= 1); KAN, TET, NEO (n= 2); KAN, TET, NAL, CIP, NEO (n= 1); TET, NAL, CIP, ERY (n= 3).	**United Kingdom**	2001	[137]
Chicken meat (free-range farming)	30	0	No MDR isolates detected.	**United Kingdom**	2001	[137]
Chicken meat (organic farming)	16	1	AMP, TET, NAL, CIP	**United Kingdom**	2001	[137]
Chicken meat (conventional farming)	1	0	No MDR isolates detected.	**United Kingdom (imported from Brazil)**	2001	[137]
Chicken meat (conventional farming)	11	4	AMP, CHL, TET, ERY (n= 1); AMP, TET, NAL, CIP (n= 3)	**United Kingdom (imported from France)**	2001	[137]
Chicken meat (free-range farming)	8	2	AMP, CHL, TET, ERY (n= 1); AMP, TET, NAL, CIP (n= 1)	**United Kingdom (imported from France)**	2001	[137]
Chicken meat (organic farming)	5	1	KAN, TET, NAL, CIP, NEO (n=1)	**United Kingdom (imported from France)**	2001	[137]
Chicken meat (conventional farming)	4	0	No MDR isolates detected.	**United Kingdom (imported from Germany)**	2001	[137]
Chicken meat (conventional farming)	1	0	No MDR isolates detected.	**United Kingdom (imported from Thailand)**	2001	[137]
Chicken meat (conventional farming)	5	2	AMP, KAN, TET, NAL, CIP, NEO (n= 1); AMP, TET, NAL, CIP, ERY (n= 1)	**United Kingdom (imported from the Netherlands)**	2001	[137]
Chicken meat (conventional farming)	15	1	KAN, TET, NAL, CIP, NEO (n= 1)	**United Kingdom (imported, country unknown)**	2001	[137]
Chicken meat (conventional farming)	2	0	No MDR isolates detected	**United Kingdom (imported from Denmark)**	2007-2008	[138]

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Chicken meat (conventional farming)	5	4	AMP, CIP, ERY, NAL, TET (n= 1); AMP, CIP, NAL, TET (n= 1); CIP, ERY, NAL, TET (n=2)	**United Kingdom (imported from France)**	2007-2008	[138]
Chicken meat (free range farming)	1	1	AMP, CIP, NAL, TET	**United Kingdom (imported; country unknown)**	2007-2008	[138]
Chicken meat (conventional farming)	11	4	AMP, CIP, ERY, NAL, TET (n= 2); AMP, CIP, NAL, TET (n= 2)	**United Kingdom (imported from Poland)**	2007-2008	[138]
Chicken meat (conventional farming)	3	2	AMP, CHL, CIP, ERY, NAL (n= 1); AMP, CIP, ERY, NAL, TET (n= 1)	**United Kingdom**	2007-2008	[138]
Chicken meat (conventional farming)	399	138	AMP, CHL, CIP, ERY, NAL (n= 2); AMP, CHL, ERY (n= 2); AMP, CIP, ERY, KAN, NAL, NEO, TET (n= 1); AMP, CIP, ERY, NAL (n= 4); AMP, CIP, ERY, NAL, TET (n= 46); AMP, CIP, KAN, NAL, NEO, TET (n= 2); AMP, CIP, NAL, TET (n= 61); AMP, ERY, NAL, TET (n= 2); AMP, ERY, TET (n= 18)	**United Kingdom**	2007-2008	[138]
Chicken meat (free range farming)	46	21	AMP, CIP, ERY, NAL, TET (n= 4); AMP, CIP, NAL, TET (n= 17)	**United Kingdom**	2007-2008	[138]
Chicken meat (organic farming)	9	7	AMP, CIP, KAN, NAL, NEO, TET (n= 1); AMP, CIP, NAL, TET (n= 6).	**United Kingdom**	2007-2008	[138]
Chicken meat (free-range farming)	13	8	CIP, ERY, NAL, STR, TET, TMP (n=1); CIP, NAL, STR, TET, TMP (n= 3); CIP, NAL, TET, TMP (n= 4)	**United Kingdom**	2014-2015	[139]
Chicken meat (organic farming)	6	5	CIP, NAL, STR, TET, TMP (n= 1); CIP, ERY, NAL, TET, TMP (n= 1); CIP, NAL, TET, TMP (n= 3)	**United Kingdom**	2014-2015	[139]
Chicken meat (conventional farming)	33	16	ERY, TET, TMP (n= 1); CIP, ERY, NAL, TET, TMP (n= 2); CIP, ERY, NAL, STR, TET, TMP (n= 1); CIP, NAL, TET, TMP (n= 7); NAL, TET, TMP (n= 2); CIP, TET, TMP (n= 1); CIP, STR, TET, TMP (n= 2).	**United Kingdom**	2014-2015	[139]
Chicken meat	18	12	AMP, ERY, TET (n= 2); AMP, CIP, ERY, TET (n= 1); AMP, CIP, ERY, FAM, TET (n= 3); AMK, AMP, CIP, ERY, FAM, FIX, TET (n= 2); AMP, CIP, ERY, FAM, FOX, TET (n= 4)	Greece	2005-2010	[142]

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Chicken meat	30	8	CIP, ENR, ERY, NAL, TET (N=4); CIP, ERY, NAL, TET (n=1); ENR, GEN, NAL, TET (n=1); CIP, ENR, NAL, TET (N=2)	Italy	N/S	[144]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.114: North, Central & South America- MDR phenotypes observed in *C. coli* isolates from turkey meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
36	1	CIP, CLI, ERY, NAL, TET	Canada	2003-2004	[151]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin; **ATM**- aztreonam; **AZL**- azlocillin; **AZM**- azithromycin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **AMC**- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.115: Africa- MDR phenotypes observed in *C. coli* in poultry meat at retail level

Note: No data were available in eligible studies

Table 3.116: Asia- MDR phenotypes observed in *C. coli* isolates from chicken meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
32	20	CIP, CLI, ERY, GEN, TET (n= 19); CIP, ERY, GEN, TET (n= 1)	China	2012	[156]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

MDR phenotypes in *Campylobacter jejuni*

Table 3.117: UK & Europe- MDR phenotypes observed in *C. jejuni* isolates from poultry meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
122	10	CIP, TET, STR (n=2); CIP, NAL, STR, TET (n=8)	Poland	2009-2011	[135]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.118: UK & Europe- MDR phenotypes observed in *C. jejuni* isolates from chicken meat

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Chicken meat (free range farming)	32	3	AMP, KAN, TET, NEO (n= 2); AMP, TET, NAL, CIP (n= 1).	**United Kingdom**	2001	[137]
Chicken meat (conventional farming)	1,046	126	AMP, CHL, NAL (n= 2); AMP, CHL, TET (n= 2); AMP, CHL, TET, NAL (n= 2); AMP, KAN, NEO (n= 1); AMP, KAN, TET, NEO (n= 39); AMP, KAN, TET, NAL, CIP, NEO (n= 2); AMP, KAN, TET, NAL, NEO (n= 1); AMP, NAL, CIP, ERY (n= 1); AMP, TET, NAL (n= 4); AMP, NAL, CIP, ERY (n= 1); AMP, TET, NAL, CIP (n= 62); KAN, NAL, CIP, NEO (n= 1); KAN, TET, NEO (n= 8).	**United Kingdom**	2001	[137]
Chicken meat (organic farming)	9	3	AMP, KAN, TET, NEO (n= 1); AMP, KAN, TET, NAL, CIP, NEO (n= 2)	**United Kingdom**	2001	[137]
Chicken meat (conventional farming)	30	0	No MDR isolates detected.	**United Kingdom (imported from the Republic of Ireland)**	2001	[137]
Chicken meat (conventional farming)	1	1	AMP, TET, NAL, CIP	**United Kingdom (imported from Thailand)**	2001	[137]
Chicken meat (conventional farming)	25	0	No MDR isolates detected.	**United Kingdom (imported from the Netherlands)**	2001	[137]
Chicken meat	64	N/S	CIP, ERY, GEN, KAN, NEO, NAL, TET	**United Kingdom**	2003-2005	[134]
Chicken meat (free-range farming)	7	1	MDR: AMP, CIP, NAL, TET	**United Kingdom**	2007-2008	[138]
Chicken meat (conventional farming)	510	101	AMP, CIP, ERY, NAL (n= 3); AMP, CIP, ERY, NAL, TET (n= 4); AMP, CIP, KAN, NAL, NEO, TET (n= 1); AMP, CIP, NAL, TET (n= 86); AMP, ERY, NAL, TET (n=1); AMP, ERY, TET (n= 3); AMP, NAL, TET (n= 3)	**United Kingdom**	2007-2008	[138]
Chicken meat (conventional farming)	2	1	AMP, CIP, NAL, TET	**United Kingdom (imported EU, country unknown)**	2007-2008	[138]
Chicken meat	6	2	AMP, CIP, NAL; AMP, NAL, TET (n= 2)	**United Kingdom**	2007-2008	[138]

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
(conventional farming)				**(imported, country unknown)**		
Chicken meat (conventional farming)	7	4	AMP, CIP, NAL, TET (n= 2); AMP, CIP, ERY, NAL; AMP, ERY, NAL, TET;	**United Kingdom (imported from Poland)**	2007-2008	[138]
Chicken meat (free-range farming)	27	9	CIP, NAL, TET, TMP (n= 8); NAL, TET, TMP (n= 1)	**United Kingdom**	2014-2015	[139]
Chicken meat (organic farming)	5	1	CIP, NAL, TET, TMP	**United Kingdom**	2014-2015	[139]
Chicken meat (conventional farming)	198	86	CIP, ERY, TET, TMP (n= 1); CIP, ERY, NAL, TET, TMP (n= 1); CIP, NAL, TET, TMP (n= 71); CIP, NAL, TET, TMP (n= 3); CIP, STR, TMP (n= 1); NAL, TET, TMP (n= 9)	**United Kingdom**	2014-2015	[139]
Chicken meat	145	1	CIP, GEN, TET, STR	Belgium	2007	[165]
Chicken meat	207	2	CIP, ERY, TET	Denmark	1996 - 1998	[164]
Chicken meat	33	N/S	CIP, ENR, ERY, GEN, NAL, TET, STR	Denmark	2011	[66]
Chicken meat	23	13	AMP, ERY, TET (n= 2); AMP, CIP, ERY, TET (n= 4); AMP, CIP, ERY, FAM, FOX, TET (n= 3); AMK, AMP, CIP, ERY, FAM, FOX, CTX, TET (n= 1); AMK, AMP, CIP, ERY, FAM, FOX, TET (n= 3)	Greece	2005-2010	[142]
Chicken meat	23	4	CIP, ENR, ERY, NAL, TET (n=2); CIP, ENR, ERY, NAL, TET (n=2)	Italy	N/S	[144]
Chicken meat	35	N/S	GEN, ENR , ERY, NAL, OXY	Norway	2005	[167]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.119: North, Central & South America- MDR phenotypes observed in *C. jejuni* isolates from poultry meat

Note: No data were available in eligible studies

Table 3.120: Africa- MDR phenotypes observed in *C. jejuni* isolates from poultry meat

Note: No data were available in eligible studies

Table 3.121: Asia- MDR phenotypes observed in *C. jejuni* isolates from chicken meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
14	3	CIP, CLI, GEN, TET (n=1); CIP, GEN, TET (n=2)	China	2012	[156]
70	N/S	CIP, NAL, NEO, STR, TET	Iran	2006-2007	[158]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**-carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**-cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**-cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**-erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**-gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**-lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**-miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**-ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**-spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**-piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

MDR phenotypes in *Campylobacter lari*

Table 3.122: UK & Europe- MDR phenotypes observed in *C. lari* isolates from chicken meat

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Chicken meat (conventional farming)	2	0	No MDR isolates detected	**United Kingdom**	2007-2008	[138]

Table 3.123: North, Central & South America- MDR phenotypes observed in *C. lari* isolates from chicken meat

Note: No data were available in eligible studies

Table 3.124: Africa- MDR phenotypes observed in *C. lari* isolates from chicken meat

Note: No data were available in eligible studies

Table 3.125: Asia- MDR phenotypes observed in *C. lari* isolates from chicken meat

Note: No data were available in eligible studies

Enterococcus faecalis

Table 3.126: UK & Europe - Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from chicken meat

Number of food samples	Number of isolates	PENICILLINS			CARBAPENEMS		(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% PEN	% IPM	% MEM	% CIP	% ENR	% ERY	% TYL			
237	51	--	--	90	--	--	0	--	33	33	**United Kingdom**	2001-2002	[60]
17	17	--	--	0	--	--	--	--	29	--	Denmark	1999	[61]
15	15	--	--	0	--	--	--	--	33	--	Denmark (domestic production)	2001	[15]
39	39	--	--	0	--	--	--	--	21	--	Denmark (domestic production)	2002	[16]
40	40	--	--	0	--	--	--	--	28	--	Denmark (domestic production)	2003	[17]
74	74	--	--	1	--	--	--	--	34	--	Denmark (domestic production)	2004	[18]
40	40	--	--	0	--	--	--	--	33	--	Denmark (imported, country of origin unknown)	2004	[18]

Number of food samples	Number of isolates	PENICILLINS			CARBAPENEMS		(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% PEN	% IPM	% MEM	% CIP	% ENR	% ERY	% TYL			
180	180	--	0	--	--	--	--	--	11	--	Denmark (domestic production)	2006	[20]
317	317	--	0	--	--	--	--	--	36	--	Denmark (imported, country of origin unknown)	2006	[20]
235	235	--	0	--	--	--	--	--	52	--	Denmark (imported, country of origin unknown)	2006	[20]
51	51	--	0	0	--	--	--	--	12	--	Denmark (domestic production)	2008	[62]
114	114	--	0	0	--	--	--	--	51	--	Denmark (imported)	2008	[62]
159	39	--	0	0	--	--	--	--	26	--	Denmark (domestic production)	2009	[63]
246	88	--	0	0	--	--	--	--	50	--	Denmark (imported, country of origin unknown)	2009	[63]
187	59	--	2	2	--	--	0	--	17	--	Denmark (domestic production)	2010	[64]
170	59	--	2	--	--	--	--	--	17	--	Denmark	2010	[65]
226	104	--	0	0	--	--	0	--	39	--	Denmark (imported, country of origin unknown)	2010	[64]
34	34	--	0	0	--	--	0	--	18	--	Denmark (domestic production)	2011	[64]
170	34	--	0	--	--	--	--	--	18	--	Denmark	2011	[66]
69	69	--	0	0	--	--	4	--	49	--	Denmark (imported, country of origin unknown)	2011	[64]
75	75	--	0	0	--	--	0	--	21	--	Denmark (domestic production)	2012	[67]
170	128	--	3.1	3.1	--	--	0	--	7.8	--	Denmark	2012	[7]

Number of food samples	Number of isolates	PENICILLINS			CARBAPENEMS		(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% PEN	% IPM	% MEM	% CIP	% ENR	% ERY	% TYL			
93	93	--	0	0	--	--	2	--	54	--	Denmark (imported, country of origin unknown)	2012	[67]
66	66	--	2	2	--	--	0	--	8	--	Denmark (domestic production)	2013	[68]
64	64	--	22	22	--	--	2	--	53	--	Denmark (domestic production)	2013	[68]
170	66	--	1.5	1.5	--	--	2.3	--	7.6	--	Denmark	2013	[3]
N/S	1[^1]	0	0	--	0	0	--	0	1	--	Germany	N/S	[69]
300	28	--	64	11	--	--	64	--	61	--	Greece	2010-2012	[70]
12	8[^1]	--	0	--	--	--	--	--	8	--	Italy	2002	[71]
238	30	0	0	6.7	--	--	10	--	30	--	Italy	2012	[176]
N/S	224	--	1.8	--	--	--	3.1	--	52	--	The Netherlands	2013	[88]
29	29	--	0	--	--	--	--	--	17	--	Norway	2004	[177]
14	14	--	0	--	--	--	--	--	2	--	Norway	2006	[167]
170	17	--	0	100	--	--	--	--	0	--	Slovenia	2013	[3]
100	81	--	0	--	--	--	--	--	23	--	Sweden	N/S	[76]
96	78	--	0	--	--	--	--	--	13	--	Sweden	N/S	[178]
100	103	--	4.9	4.9	--	--	35	--	59	--	Turkey	N/S	[179]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **MEM**- meropenem; **PEN**- penicillin (generic); **TYL**- tylosin

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.127: UK & Europe - Antimicrobial resistance o beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from turkey meat

Number of food samples	Number of isolates	PENICILLINS		(FLUORO)QUINOLONES	MACROLIDES		Country	Year	References
		% AMP	% PEN	% CIP	% ERY	% TYL			
227	110	--	84	0	42	42	**United Kingdom**	2001-2002	[60]
N/S	330	1.5	--	3.6	62	--	The Netherlands	2010-2011	[73]
N/S	38	0	--	7.9	58	--	The Netherlands	2010-2011	[73]

AMP- ampicillin; **CIP**- ciprofloxacin; **ERY**- erythromycin; **TYL**- tylosin

Table 3.128: North, Central & South America - Antimicrobial resistance o beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from poultry meat

Number of food samples	Number of isolates	CARBAPENEMS	MACROLIDES	Country	Year	References
		% IPM	% ERY			
25	41	0	90	Brazil	2002-2004	[180]

ERY- erythromycin; **IPM-** imipenem

Table 3.129: North, Central & South America - Antimicrobial resistance o beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from chicken meat

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES	MACROLIDES	Country	Year	References

		% AMC	% PEN	% CIP	% ENR	% ERY	% TYL			
206	192	--	--	--	--	47	49	Canada	2007-2008	[77]
N/S	38	--	--	0	--	47.4	47.4	Canada (British Columbia)	2007	[92]
N/S	70	--	0	0	--	54.3	52.9	Canada (British Columbia)	2008	[36]
N/S	63	--	0	3.2	--	49.2	49.2	Canada (British Columbia)	2009	[93]
N/S	138	--	0	0	--	44.2	44.2	Canada (Ontario)	2005	[97]
N/S	147	--	0	0	--	38.8	38.8	Canada (Ontario)	2006	[98]
N/S	154	--	--	0.6	--	39.6	39.6	Canada (Ontario)	2007	[92]
N/S	148	--	0	1.4	--	49.3	50	Canada (Ontario)	2008	[36]
N/S	151	--	0	0.7	--	54.3	54.3	Canada (Ontario)	2009	[93]
N/S	73	--	0	0	--	38.4	39.7	Canada (Saskatchewan)	2005	[97]
N/S	80	--	0	0	--	36.3	36.3	Canada (Saskatchewan)	2006	[98]
N/S	68	--	--	0	--	44.1	44.1	Canada (Saskatchewan)	2007	[92]
N/S	85	--	0	1.2	--	69.4	69.4	Canada (Saskatchewan)	2008	[36]
N/S	86	--	0	0	--	59.3	59.3	Canada (Saskatchewan)	2009	[93]
N/S	137	--	0	0	--	41.6	41.6	Canada (Quebec)	2005	(121)
N/S	136	--	0	0	--	45.2	45.2	Canada (Quebec)	2006	[98]
N/S	128	--	--	0	--	47.7	47.7	Canada (Quebec)	2007	[92]
N/S	133	--	0	0	--	54.9	54.1	Canada (Quebec)	2008	[36]
N/S	26	--	0	1.6	--	61.1	61.1	Canada (Quebec)	2009	[93]
1,003	556	--	--	--	--	77	--	Columbia	2008-2013	[127]
200	161	0	0.6	27.3	80.6	82	--	Columbia	2009	[181]
11	13	--	0	0	38.5	--	38.5	United States	2000-2001	[78]
N/S	134	--	0	0	--	45.5	48.5	United States	2002	[14]
N/S	188	--	0	0	--	43.1	42.6	United States	2003	[14]
N/S	88	--	0	8	--	35.2	34.1	United States	2004	[14]
N/S	116	--	0	0.9	--	37.1	37.1	United States	2005	[14]
N/S	126	--	0	0.8	--	34.9	36.5	United States	2006	[14]
N/S	123	--	0	0	--	44.7	44.7	United States	2007	[14]

Number of food samples	Number of isolates	PENICILLINS		(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% PEN	% CIP	% ENR	% ERY	% TYL			
N/S	165	--	0	3	--	32.7	32.7	United States	2008	[14]
N/S	138	--	0	0	--	39.9	39.9	United States	2009	[14]
N/S	214	--	1	0	--	32.2	32.2	United States	2010	[14]
N/S	186	--	0	0	--	35.5	35.5	United States	2011	[14]
N/S	204	--	0	0	--	34.3	34.3	United States	2012	[14]
N/S	202	--	0	0.5	--	35.1	35.1	United States	2013	[14]

AMC- amoxicillin-clavulanic acid; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **PEN**- penicillin (generic); **TYL**- tylosin

Table 3.130: North, Central & South America - Antimicrobial resistance o beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from turkey meat

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% PEN	% CIP	% ENR	% ERY	% TYL			

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% PEN	% CIP	% ENR	% ERY	% TYL			
91	87	--	--	--	28	29	Canada	2007-2008	[77]
11	17	0	0	0	--	35.3	United States	2000-2001	[78]
N/S	294	0	0.3	--	31	32	United States	2002	[14]
N/S	289	0	0	--	43.6	43.9	United States	2003	[14]
N/S	260	0	5.8	--	33.8	34.6	United States	2004	[14]
N/S	339	1.5	2.4	--	38.3	38.3	United States	2005	[14]
N/S	291	0.3	0.7	--	47.1	47.1	United States	2006	[14]
N/S	261	0	0	--	48.7	49.4	United States	2007	[14]
N/S	271	0	3.3	--	51.7	51.3	United States	2008	[14]
N/S	260	0	0.8	--	37.7	37.7	United States	2009	[14]
N/S	369	0.3	0	--	37.9	40.4	United States	2010	[14]
N/S	392	0	0.3	--	47.2	47.2	United States	2011	[14]
N/S	384	0.3	0	--	37	37	United States	2012	[14]
N/S	407	0	0	--	39.3	39.1	United States	2013	[14]

AMC- amoxicillin-clavulanic acid; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **PEN**- penicillin (generic); **TYL**- tylosin

Table 3.131: Africa - Antimicrobial resistance o beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from poultry meat

e r o f f o o d s a m	m b e r o f i s o _ a t	M A C R O _ I _ D E S	C o u n t r y	Y e a r	R e f e r e n c e s

		% ERY			
51	49	55	Tunisia	2010-2011	[182]

ERY- erythromycin

Table 3.132: Africa - Antimicrobial resistance o beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from chicken meat

Number of food samples	Number of isolates	PENICILLINS	Country	Year	References
		% AMP			
58	107	93.5	Botswana	1999	[183]

AMP- ampicillin

Table 3.133: Asia - Antimicrobial resistance o beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from poultry meat

Note: No data were available in eligible studies

MDR phenotypes in *Enterococcus faecalis*

Table 3.134: UK & Europe - MDR phenotypes observed in *E. faecalis* isolates from poultry meat

Note: No data were available for the UK in eligible studies

Total number of isolates tested	Number of MDR isolates	MDR agents	Country	Year	References
28	N/S	AMP, CHL, CIP, ERY, PEN, TET, VAN	Greece	2010-2012	[70]
30	N/S	CHL, CIP, ERY, GEN, PEN, TEC, TET, VAN	Italy	2012	[176]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.135: UK & Europe - MDR phenotypes observed in *E. faecalis* isolates from chicken meat

Note: No data were available for the UK in eligible studies

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
34	1	AMP, CHL, CIP, CTX, ENR, ERY, GEN, NAL, STR, SUL, TET, TMP	Denmark	2011	[66]
29	N/S	AMP, AVI, BAC, CHL, ERY, FLA, GEN, NEO, TET, STR, VAN, VIR, NAR	Norway	2004	[177]
103	N/S	AMP, CIP, CHL, ERY, GEN, PEN, TEC, TET, SXT, VAN	Turkey	N/S	[179]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.136: North, Central & South America- MDR phenotypes observed in *E. faecalis* isolates from poultry meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
41	19	CHL, ERY, TET (n= 4); ERY, STR, TET (n= 11); CHL, STR, TET (n= 1); CHL, ERY TET, STR, (n= 3)	Brazil	2002-2004	[180]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.137: North, Central & South America- MDR phenotypes observed in *E. faecalis* isolates from chicken meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
143	30	BAC, ERY, TET, TYL (n= 26); BAC, ERY, GEN, KAN, STR, TET, TYL (n= 4)	Canada (Ontario)	2004	[96]
152	34	BAC, ERY, TET, TYL (n= 30) BAC, ERY, GEN, KAN, LMC, STR, TET, TYL (n= 4)	Canada (Quebec)	2004	[96]
161	23	CLI, ERY, ENR, STH, STR, TYL, TET, TIO (n= 23)	Columbia	2009	[181]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.138: Africa - MDR phenotypes observed in *E. faecalis* isolates from poultry meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
49	N/S	CHL, ERY, STR, TET	Tunisia	2010-2011	[182]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.139: Africa - MDR phenotypes observed in *E. faecalis* isolates from poultry meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
107	17	AMP, CEF, VAN (n= 12);	Botswana	1999	[183]

		AMP, CEF, TEC (n= 3); AMP, TEC, TET, VAN (n= 2)			

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**-carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**-cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**-cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**-erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**-gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**-lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**-miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**-ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**-spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**-piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.140: Asia- MDR phenotypes observed in *E. faecalis* isolates from chicken meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
101	11	CIP, GEN, LMC, TET (n= 1); CHL, ERY, GEN, LMC, TET (n= 1); CHL, ERY, GEN, STR, TET (n= 2); ERY, GEN, TET (n= 1); ERY, GEN, STR, TET (n= 3); CHL, CIP, GEN, TET, (n= 2); CHL, CIP, GEN, ERY, STR, TET (n= 1)	South Korea	2003-2010	[184]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Enterococcus faecium

Table 3.141: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from poultry meat

Note: No data were available for the UK in eligible studies.

Number of food samples	Number of isolates	PENICILLINS			(FLUORO)QUINOLONES	MACROLIDES	Country	Year	References
		% AMC	% AMP	% PEN	% CIP	% ERY			
12	7[^1]	--	1	--	--	7	Italy	2002	[71]
238	25	4	8	24	12	52	Italy	2012	[176]
80	10	--	10	--	20	20	Spain	N/A	[82]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CIP**- ciprofloxacin; **ERY**- erythromycin; **PEN**- penicillin (generic)

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.142: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from chicken meat

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES	MACROLIDES	Country	Year	References

		% AMP	% PEN	% CIP	% ERY	% TYL			
237	245	--	98	22	20	16	**United Kingdom**	2001-2002	[60]
227	213	--	96	41	53	37	**United Kingdom**	2001-2002	[60]
N/S	24	12.5	--	--	--	54.2	Belgium	1998-1999	[80]
45	45	--	16	--	27	--	Denmark	1999	[61]
25	25	--	8	--	32	--	Denmark (domestic production)	2001	[15]
19	19	--	5	--	26	--	Denmark (imported, country of origin unknown)	2001	[15]
48	48	--	15	--	6	--	Denmark (domestic production)	2002	[16]
29	29	--	15	--	24	--	Denmark (imported, country of origin unknown)	2002	[16]
70	70	--	21	--	20	--	Denmark (domestic production)	2003	[17]
22	22	--	9	--	23	--	Denmark (imported, country of origin unknown)	2003	[17]
173	173	--	10	--	24	--	Denmark (domestic production)	2004	[18]
69	69	--	7	--	39	--	Denmark (imported, country of origin unknown)	2004	[18]
306	306	<1	--	--	21	--	Denmark (domestic production)	2006	[20]
351	351	10	--	--	40	--	Denmark (imported, country of origin unknown)	2006	[20]
81	81	1	1	--	19	--	Denmark (domestic production)	2008	[62]
115	115	14	14	--	53	--	Denmark (imported, country of origin unknown)	2008	[62]
159	98	1	2	--	16	--	Denmark (domestic production)	2009	[63]
246	90	24	23	--	61	--	Denmark (imported, country of origin unknown)	2009	[63]
187	145	1	1	--	21	--	Denmark (domestic production)	2010	[64]
226	107	25	26	--	63	--	Denmark (imported, country of origin unknown)	2010	[64]
83	83	2	2	0	19	--	Denmark (domestic production)	2011	[64]
64	64	27	28	0	61	--	Denmark (imported, country of origin unknown)	2011	[64]
128	128	3	3	0	8	--	Denmark (domestic production)	2012	[67]
82	82	15	16	1	61	--	Denmark (imported, country of origin unknown)	2012	[67]
62	62	--	0	0	23	--	Denmark (domestic production)	2013	[68]
93	93	--	0	6	63	--	Denmark (imported, country of origin unknown)	2013	[68]

Number of food samples	Number of isolates	PENICILLINS		(FLUORO)QUINOLONES	MACROLIDES		Country	Year	References
		% AMP	% PEN	% CIP	% ERY	% TYL			
170	145	1	--	--	21	--	Denmark	2010	[65]
170	83	2.4	--	--	19.3	--	Denmark	2011	[66]
170	75	0	0	0	21.3	--	Denmark	2012	[66]
170	62	0	0	0	6.5	--	Denmark	2013	[3]
300	12.3	7.7	6.3	7.7	6	--	Greece	2010-2012	[70]
N/S	86	9.3	--	20.9	48.8	--	The Netherlands	2010-2011	[73]
50	50	0	--	--	24	--	Norway	2004	[177]
89	89	0	--	--	21.3	--	Norway	2006	[167]
170	77	0	77	0	0	--	Slovenia	2013	[3]
100	17	0	--	--	6	--	Sweden	N/S	[76]
96	10	0	--	--	0	--	Sweden	N/S	[178]
N/S	1[^1]	1	1	1	--	--	Turkey	2011	[185]

AMP- ampicillin; **CIP**- ciprofloxacin; **ERY**- erythromycin; **PEN**- penicillin (generic); **TYL**- tylosin

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.143: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from turkey meat

Note- no data were available for the UK in eligible studies.

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES	MACROLIDES	Country	Year	References
		% AMP	% CIP	% ERY			
6	6[*1]	0	--	1	Denmark (domestic)	2006	[20]
244	244	5	--	42	Denmark (imported)	2006	[20]
N/S	13	38.5	0	53.8	The Netherlands	2010-2011	[73]
N/S	72	9.7	23.6	43.1	The Netherlands	2013	[88]

AMP- ampicillin; **CIP**- ciprofloxacin; **ERY**- erythromycin.

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.144: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from chicken meat

Number of food samples	Number of isolates	PENICILLINS		CARBAPENEMS	(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% PEN	% IPM	% CIP	% ENR	% ERY	% TYL			

Number of food samples	Number of isolates	PENICILLINS		CARBAPENEMS	(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% PEN	% IPM	% CIP	% ENR	% ERY	% TYL			
25	2^1	--	1	1	--	--	2	--	Brazil	2002-2004	[180]
206	9^1	--	2	--	--	--	2	2	Canada	2007-2008	[77]
N/S	42	--	0	--	0	--	0	0	Canada (British Columbia)	2007	[92]
N/S	3^1	--	1	--	0	--	1	1	Canada (British Columbia)	2008	[36]
N/S	2^1	--	2	--	2	--	1	1	Canada (British Columbia)	2009	[93]
N/S	6^1	--	4	--	1	--	4	3	Canada (Ontario)	2005	[97]
N/S	4^1	--	2	--	1	--	3	2	Canada (Ontario)	2006	[98]
N/S	161	--	25	--	0	--	50	25	Canada (Ontario)	2007	[92]
N/S	3^1	--	2	--	2	--	3	3	Canada (Ontario)	2008	[36]
N/S	4^1	--	3	--	2	--	3	3	Canada (Ontario)	2009	[93]
N/S	6^1	--	1	--	1	--	3	3	Canada (Saskatchewan)	2005	[97]
N/S	3^1	--	3	--	3	--	3	3	Canada (Saskatchewan)	2006	[98]
N/S	76	--	0	--	33 .3	--	100	100	Canada (Saskatchewan)	2007	[92]
N/S	1^1	--	1	--	0	--	1	1	Canada (Saskatchewan)	2008	[36]
N/S	1^1	--	0	--	0	--	0	0	Canada (Saskatchewan)	2009	[93]
N/S	11	--	18.2	--	0	--	63.6	63.6	Canada (Quebec)	2005	[97]
N/S	4^1	--	3	--	0	--	4	4	Canada (Quebec)	2006	[98]
N/S	141	--	100	--	60	--	100	100	Canada (Quebec)	2007	[92]
N/S	5^1	--	2	--	60	--	4	4	Canada (Quebec)	2008	[36]

Number of food samples	Number of isolates	PENICILLINS		CARBAPENEMS	(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% PEN	% IPM	% CIP	% ENR	% ERY	% TYL			
N/S	11	--	0	--	1	--	0	0	Canada (Quebec)	2009	[93]
200	26	0	11.5	--	11.5	76.9	73.1	--	Columbia	2009	[181]
N/S	231	--	44.2	--	13	--	25.5	21.2	United States	2002	[14]
N/S	248	--	51.2	--	21.8	--	13.3	12.5	United States	2003	[14]
N/S	348	--	39.1	--	52.3	--	12.6	10.3	United States	2004	[14]
N/S	307	--	31.9	--	33.9	--	13.7	12.4	United States	2005	[14]
N/S	315	--	22.2	--	37.5	--	9.5	7.9	United States	2006	[14]
N/S	189	--	12.2	--	19.6	--	19.6	19	United States	2007	[14]
N/S	163	--	27.6	--	43.6	--	22.1	20.2	United States	2008	[14]
N/S	202	--	23.3	--	34.1	--	19.8	19.3	United States	2009	[14]
N/S	197	--	24.4	--	32.5	--	13.7	12.2	United States	2010	[14]
N/S	221	--	18.6	--	33.5	--	21.7	20.4	United States	2011	[14]
N/S	235	--	11.9	--	39.6	--	21.3	20.9	United States	2012	[14]
N/S	213	--	9.9	--	39	--	29.6	27.7	United States	2013	[14]

AMC- amoxicillin-clavulanic acid; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **IPM**- imipenem; **PEN**- penicillin (generic); **TYL**- tylosin

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage

Table 3.145: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from turkey meat

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES	MACROLIDES		Country	Year	References
		% PEN	% CIP	% ERY	% TYL			
N/S	89	66.3	22.5	50.6	36	United States	2002	[14]
N/S	118	65.3	39	44.1	27.1	United States	2003	[14]
N/S	172	61.6	53.5	43	35.5	United States	2004	[14]
N/S	107	59.8	43.9	41.1	29.9	United States	2005	[14]
N/S	139	67.6	37.4	44.6	36	United States	2006	[14]
N/S	65	60	35.4	23.1	13.8	United States	2007	[14]
N/S	70	61.4	54.3	7.1	12.9	United States	2008	[14]
N/S	66	69.7	40.9	56.1	124.2	United States	2009	[14]
N/S	45	48.9	42.2	33.3	15.5	United States	2010	[14]
N/S	40	75	57.5	32.5	22.5	United States	2011	[14]
N/S	73	68.5	54.8	27.4	17.8	United States	2012	[14]
N/S	48	54.1	35.4	39.6	20.8	United States	2013	[14]

CIP- ciprofloxacin; **ERY**- erythromycin; **PEN**- penicillin (generic); **TYL**- tylosin

Table 3.146: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from poultry meat

Note: resistance to beta-lactams and fluoroquinolones was not explored in eligible studies.

Number of food samples	Number of isolates	MACROLIDES	Country	Year	References
		% ERY			
51	30	36.7	Tunisia	2010-2011	[182]

ERY- erythromycin.

Table 3.147: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from chicken meat

Note: resistance to fluoroquinolones and macrolides was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS	Country	Year	References
		% AMP			

Number of food samples	Number of isolates	PENICILLINS	Country	Year	References
		% AMP			
58	75	1	Botswana	1999	[183]

AMP- ampicillin.

Table 3.148: Asia - Antimicrobial resistance observed to beta-lactams, fluoroquinolones and macrolides in *E. faecium* isolates from poultry meat

Note: No data were available in eligible studies

MDR phenotypes in *Enterococcus faecium*

Table 3.149: UK & Europe- MDR phenotypes observed in *E. faecium* isolates from poultry meat

Note: No data were available for the UK in eligible studies.

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
24	N/S	AMP, AVO, BAC, MIN, TYL, VIR, VAN	Belgium	1998-1999	[80]
37	N/S	AMP, CHL, CIP, ERY, LZD, PEN, TET, TLC, VAN	Greece	2010-2012	[70]
25	N/S	AMC, AMP, CHL, ERY, GEN, LZD, PEN, TEC, TET, VAN	Italy	2012	[176]
10	3	TEC, AMP, TET, ERY, Q-D, CIP; TEC, AMP, CHL, ERY, Q-D, CIP; TEC, AMP, CHL, TET, ERY, Q-D, CIP	Spain	N/S	[82]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Ceftiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.150: UK & Europe- MDR phenotypes observed in *E. faecium* isolates from chicken meat

Note: No data were available for the UK in eligible studies.

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
83	N/S	AMP, CHL, CIP, CTX, ENR, ERY, GEN, NAL, STR, SUL, TET, TMP	Denmark	2011	[66]
50	N/S	AMP, AVO, BAC, CHL, ERY, FLA, GEN, NEO, TET, VAN, VIR, NOR	Norway	2004	[177]
4	4	AMP, CIP, PEN, TEC, TET, VAN (n= 1); TEC, TET, VAN (n= 3)	Turkey	2011	[185]
2	2	VAN, TEC, TET	Turkey	2011	[185]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.151: North, Central & South America- MDR phenotypes observed in *E. faecium* isolates from poultry meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
2	2	ERY, NIT, TET; ERY, HET, PEN, TET	Brazil	2002-2004	[180]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**-

cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.152: North, Central & South America- MDR phenotypes observed in *E. faecium* isolates from chicken meat

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Chicken meat (fresh)	6	2	BAC, ERY, LIN, PEN, Q-D, TET, TYL	Canada (Ontario)	2004	[96]
Chicken meat (fresh)	5	1	BAC, ERY, LIN, NIT, PEN, Q-D STR, TET, TYL	Canada (Quebec)	2004	[96]
Chicken meat (fresh)	26	3	CLI, ERY, ENR, NIT, STH, STR, TIL, TET, TIO	Columbia	2009	[181]
Chicken meat (conventional farming)	N/S	61	ERY, PEN, TET, KAN (n=26) PEN, TET, KAN, STR (n=7) ERY, PEN, TET, AMI, CEC (n=8) ERY, PEN, TET, KAN, AMK, CHL (n= 2) ERY, PEN, TET, KAN, AZM (n= 18)	United States	2015	[186]
Chicken meat (organic farming)	N/S	21	ERY, PEN, TET, KAN (n=7) PEN, TET, KAN, STR (n=5) ERY, PEN, TET, AMK, CEC (n=3)	United States	2015	[186]

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
			ERY, PEN, TET, KAN, AMK, CHL (n= 0) ERY, PEN, TET, KAN, AZM (n= 6)			

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.153: Africa- MDR phenotypes observed in *E. faecium* in poultry meat at retail level

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
30	N/S	ERY, GEN, STR, TET	Tunisia	2010-2011	[182]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.154: Africa- MDR phenotypes observed in *E. faecium* isolates from poultry meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
75	16	AMP, CEF, VAN (n= 4); AMP, TEC, VAN (n= 4); AMP, TEC, TET, VAN (n= 5); AMP, CEF, TEC, VAN, (n= 3)	Botswana	1999	[183]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Ceftiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.155: Asia- MDR phenotypes observed in *E. faecium* isolates from poultry meat

Note: No data were available in eligible studies

Escherichia coli

Table 3.156: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from poultry meat

Note: No data were available for the UK in eligible studies.

Number of food sampels	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS			2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO) QUINOLONES			MACROLIDES		POLYMYXINS	Country	Year	References
		% AMC	% AMP	% PEN	% PIP	% CEF	% CFR	% CFZ	% CEC	% CXM	% FOX	% CAZ	% CPD	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% AZM	% ERY	% CST			
110	179	--	30	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Austria	2001-2003	[84]
110	179	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	25	--	--	--	Austria	2001-2003	[84]
80	29	13.8	55.2	--	--	--	--	--	--	--	--	--	--	--	3.5	--	--	--	--	37.9	--	55.2	--	--	3.5	Czech Republic	2012-2013	[85]
1,650	21	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	--	--	--	--	--	--	--	--	--	Denmark	2006	[187]
N/S	230	--	65	--	--	--	--	--	--	--	--	10	--	--	17	--	--	--	--	35	--	35	--	--	1	The Netherlands	2006-2007	[87]
N/S	329	--	70	--	--	--	--	--	--	--	--	14	--	--	14	--	--	--	--	45	--	45	--	--	0.5	The Netherlands	2008	[87]
N/S	328	--	68	--	--	--	--	--	--	--	--	18	--	--	21	--	--	--	--	51	--	50	--	--	3	The Netherlands	2009	[87]
N/S	277	--	66	--	--	--	--	--	--	--	--	18	--	--	19	--	--	--	--	42	--	41	--	--	0	The Netherlands	2010	[87]

Number of food sampels	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS			2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO) QUINOLONES			MACROLIDES		POLYMYXINS	Country	Year	References
		% AMC	% AMP	% PEN	% PIP	% CEF	% CFR	% CFZ	% CEC	% CXM	% FOX	% CAZ	% CPD	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% AZM	% ERY	% CST			
N/S	468	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	48.1	--	45.7	--	--	--	The Netherlands	2010-2011	[73]
N/S	468	--	--	--	--	--	--	--	--	--	--	19	--	--	20.3	--	--	--	--	--	--	--	--	--	--	The Netherlands	2010-2011	[73]
N/S	468	--	65.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	The Netherlands	2010-2011	[73]
N/S	292	--	64	--	--	--	--	--	--	--	--	20	--	--	21	--	--	--	--	57	--	54	--	--	3	The Netherlands	2011	[87]
N/S	476	--	51.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	The Netherlands	2013	[88]
N/S	476	--	--	--	--	--	--	--	--	--	--	10.7	--	--	10.7	--	--	--	--	--	--	--	--	--	--	The Netherlands	2013	[88]
N/S	476	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	45.2	--	42.4	--	--	--	The Netherlands	2013	[88]
N/S	531	--	40.7	--	--	--	--	--	--	--	--	3	--	--	1.9	--	--	--	0	31.3	--	27.3	0	--	1.5	The Netherlands	2014	[74]
N/S	52	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	40.4	--	78.9	--	--	--	Spain	2007	[188]
N/S	52	1.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Spain	2007	[188]
N /S	52	--	--	--	--	--	--	--	--	100	0	--	--	--	--	--	3.8	--	--	--	--	--	--	--	--	Spain	2007	[188]
30	62	3.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Spain	2010	[188]
30	62	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	32.2	--	85.4	--	--	--	Spain	2010	[188]
30	62	--	--	--	--	--	--	--	--	100	3.2	--	--	--	--	--	0	--	--	--	--	--	--	--	--	Spain	2010	[188]
56	48	0	72.9	--	60.4	--	--	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Turkey	2007-2008	[189]
56	48	--	--	--	--	--	--	--	--	0	--	0	--	--	--	--	--	0	--	--	--	--	--	--	--	Turkey	2007-2008	[189]
56	48	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	47.9	--	--	--	93.8	--	Turkey	2007-2008	[189]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **AZM**- azithromycin; **CAZ**- ceftazidime; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFR**- cefadroxil; **CFZ**- cephazolin; ; **CIP**- ciprofloxacin; **CPD**- cefpodoxime; **CST**- colistin; **CRO**- ceftriaxone; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **ENR**- enrofloxacin; **ERY**- erythromycin; **FEP**- cefepime; **FOX**- cefoxitin; **IPM**- imipenem; **MEM**- meropenem; **NAL**- nalidixic acid; **PEN**- penicillin (generic); **PIP**- piperacillin; **TIO-** cefiofur

Table 3.127: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from chicken meat

Note: No data were available for the UK in eligible studies

Number of food sampels	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS			2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)-QUINOLONES			MACROLIDES		POLYMYXINS	Country	Year	References
		% AMC	% AMP	% PEN	% PIP	% CEF	% CFR	% CFZ	% CEC	% CXM	% FOX	% CAZ	% CPD	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% AZM	% ERY	% CST			
50	26	--	--	--	--	--	--	--	--	--	7.7	46.2	--	--	--	--	34.6	--	--	--	--	--	--			Austria	2012	[190]
N/S	75	27	36	--	--	--	--	--	--	0	--	--	--	--	0	--	--	0	--	17	--	--	--	--	--	Czech Republic	2015	[191]
79	79	--	11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	--	16	--	--	--	Denmark	1999	(68)
87	87	--	10	--	--	--	--	--	--	--	--	--	--	--	--	0	--	--	--	1	--	9	--	--	--	Denmark (domestic production)	2001	[15]
35	35	--	43	--	--	--	--	--	--	--	--	--	--	--	--	0	--	--	--	6	--	31	--	--	--	Denmark (imported, country	2001	[15]

Number of food sampels	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS			2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)-QUINOLONES			MACROLIDES		POLYMYXINS	Country	Year	References
		% AMC	% AMP	% PEN	% PIP	% CEF	% CFR	% CFZ	% CEC	% CXM	% FOX	% CAZ	% CPD	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% AZM	% ERY	% CST			
																										of origin unknown)		
57	57	--	14	--	--	4	--	--	--	--	--	--	--	--	--	0	--	--	--	0	--	9	--	--	--	Denmark (domestic production)	2002	[16]
27	27	--	33	--	--	4	--	--	--	--	--	--	--	--	--	0	--	--	--	0	--	11	--	--	--	Denmark (imported, country of origin unknown)	2002	[16]
153	153	0	10	--	--	2	--	--	--	--	--	--	--	--	--	0	--	--	--	0	--	10	--	--	0	Denmark (domestic production)	2003	[17]
22	22	0	18	--	--	0	--	--	--	--	--	--	--	--	--	0	--	--	--	0	--	5	--	--	0	Denmark (imported, country of origin unknown)	2003	[17]
216	216	0	15	--	--	3	--	--	--	--	--	--	--	--	--	0	--	--	--	0	--	6	--	--	0	Denmark (domestic production)	2004	[18]
93	93	0	41	--	--	7	--	--	--	--	--	--	--	--	--	0	--	--	--	4	--	24	--	--	0	Denmark (imported, country of origin unknown)	2004	[18]
534	534	0	15	--	--	2	--	--	--	--	--	--	<2	--	--	<1	--	--	--	4	--	6	--	--	--	Denmark (domestic production)	2006	[20]
550	550	5	46	--	--	11	--	--	--	--	--	--	7	--	--	5	--	--	--	24	--	26	--	--	--	Denmark (imported, country of origin unknown)	2006	[20]
113	113	--	11	--	--	--	--	--	--	--	--	--	--	--	1	1	--	--	--	4	--	3	--	--	--	Denmark (domestic production)	2008	[62]
304	304	--	48	--	--	--	--	--	--	--	--	--	--	--	8	8	--	--	--	33	--	32	--	--	--	Denmark (imported, country of origin unknown)	2008	[62]
259	143	--	20	--	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	4	--	4	--	--	0	Denmark (domestic production)	2009	[63]

Number of food sampels	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS			2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)-QUINOLONES			MACROLIDES		POLYMYXINS	Country	Year	References
		% AMC	% AMP	% PEN	% PIP	% CEF	% CFR	% CFZ	% CEC	% CXM	% FOX	% CAZ	% CPD	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% AZM	% ERY	% CST			
254	221	--	55	--	--	--	--	--	--	--	--	--	--	--	4	4	--	--	--	41	--	40	--	--	3.6	Denmark (imported, country of origin unknown)	2009	[63]
193	69	--	--	--	--	--	--	--	--	--	--	--	--	36	--	--	--	--	--	--	--	--	--	--	--	Denmark (imported, country of origin unknown)	2009	[63]
187	158	--	16	--	--	--	--	--	--	--	--	--	--	--	1	1	--	--	--	4	--	4	--	--	0	Denmark (domestic production)	2010	[64]
226	177	--	58	--	--	--	--	--	--	--	--	--	--	--	7	7	--	--	--	41	--	38	--	--	6.2	Denmark (imported, country of origin unknown)	2010	[64]
170	158	--	10	--	--	--	--	--	--	--	--	--	--	--	0.6	--	--	--	--	4	--	4	--	--	0	Denmark	2010	[65]
187	158	--	16	--	--	--	--	--	--	--	--	--	--	50	1	1	--	--	--	--	--	--	--	--	--	Denmark (domestic production)	2010	[64]
226	177	--	58	--	--	--	--	--	--	--	--	--	--	8.6	7	7	--	--	--	--	--	--	--	--	--	Denmark (imported, country of origin unknown)	2010	[64]
170	122	--	23	--	--	--	--	--	--	--	--	--	--	--	2.5	2.5	--	--	--	0	--	5.7	--	--	--	Denmark	2011	[66]
158	122	--	23	--	--	--	--	--	--	--	--	--	--	--	2	2	--	--	--	6	--	6	--	--	--	Denmark (domestic production)	2011	[64]
177	140	--	57	--	--	--	--	--	--	--	--	--	--	--	7	7	--	--	--	41	--	39	--	--	--	Denmark (imported, country of origin unknown)	2011	[64]
132	132	--	--	--	--	--	--	--	--	--	--	--	--	44	--	--	--	--	--	--	--	--	--	--	--	Denmark (domestic production)	2011	[64]
152	152	--	--	--	--	--	--	--	--	--	--	--	--	48	--	--	--	--	--	--	--	--	--	--	--	Denmark (imported, country of origin unknown)	2011	[64]
197	197	--	22	--	--	--	--	--	--	--	--	--	--	--	1	1	--	--	--	4	--	4	--	--	1	Denmark (domestic	2012	[67]

Number of food sampels	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS			2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)-QUINOLONES			MACROLIDES		POLYMYXINS	Country	Year	References
		% AMC	% AMP	% PEN	% PIP	% CEF	% CFR	% CFZ	% CEC	% CXM	% FOX	% CAZ	% CPD	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% AZM	% ERY	% CST			
																										production)		
166	166	--	51	--	--	--	--	--	--	--	--	--	--	--	9	8	--	--	--	36	--	36	--	--	3	Denmark (imported, country of origin unknown)	2012	[67]
170	197	--	21.8	0	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	3.6	--	3.6	--	--	0	Denmark	2012	[66]
206	206	--	--	--	--	--	--	--	--	--	--	--	--	36	--	--	--	--	--	--	--	--	--	--	--	Denmark (domestic production)	2012	[67]
178	178	--	--	--	--	--	--	--	--	--	--	--	--	61	--	--	--	--	--	--	--	--	--	--	--	Denmark (imported, country of origin unknown)	2012	[67]
170	116	--	24.1	--	--	--	--	--	--	--	--	--	--	--	1.7	1.7	--	--	--	5.2	--	5.2	--	--	0	Denmark	2013	[3]
116	116	--	24	--	--	--	--	--	--	--	--	--	--	--	2	2	--	--	--	5	--	5	--	--	0	Denmark (domestic production)	2013	[68]
136	136	--	64	--	--	--	--	--	--	--	--	--	--	--	9	9	--	--	--	36	--	35	--	--	1	Denmark (imported, country of origin unknown)	2013	[68]
172	172	--	--	--	--	--	--	--	--	--	--	--	--	89	--	--	--	--	--	--	--	--	--	--	--	Denmark (imported, country of origin unknown)	2013	[68]
146	146	--	--	--	--	--	--	--	--	--	--	--	--	25	--	--	--	--	--	--	--	--	--	--	--	Denmark (domestic production)	2013	[68]
250	187	18.2	46.1	--	31.1	--	--	--	12.4	2.6	3.2	0	--	--	0	1.1	0	2	0	5.3	6	--	--	--	0	Germany	2004	[22]
19	8[*1]	0	4	--	--	--	--	--	--	3	--	--	--	--	0	0	--	0	--	5	--	--	--	--	--	Greece	2004-2007	[81]
50	75	--	16	--	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	36	33	36	--	--	--	Iceland	2006-2007	[86]
109	134	68.7	--	--	--	--	--	--	--	--	17.9	91.7	--	--	91.7	--	17.9	0	--	88.8	--	--	--	--	--	Italy	2015	[192]
163	92	--	--	--	--	--	--	--	--	--	--	100	--	--	100	--	--	--	--	14	--	--	--	--	--	The Netherlands	2010	[193]

Number of food sampels	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS			2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)-QUINOLONES			MACROLIDES		POLYMYXINS	Country	Year	References
		% AMC	% AMP	% PEN	% PIP	% CEF	% CFR	% CFZ	% CEC	% CXM	% FOX	% CAZ	% CPD	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% AZM	% ERY	% CST			
87	87	--	23	--	--	--	--	--	--	--	--	--	--	--	--	0	--	--	--	--	3	3	--	--	--	Norway	2004	[177]
119	119	--	7.6	--	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	0	--	0	--	--	--	Norway	2006	[167]
170	197	--	6.1	0	--	--	--	--	--	--	--	--	--	--	0.5	--	--	--	--	--	--	2	--	--	--	Norway	2012	[66]
196	196	--	5.6	--	--	--	--	--	--	--	--	1	--	--	0.5	--	--	--	--	2.6	--	2	--	--	--	Norway	2012	[194]
66	66	--	100	--	--	--	--	--	--	--	--	100	--	--	100	--	--	--	--	0	--	1.5	--	--	--	Norway	2012	[194]
19	7[*1]	--	7	--	--	--	7	7	--	--	0	5	5	7	5	--	0	0	0	2	--	--	--	--	--	Poland	2014	[89]
19	5[*1]	--	5	--	--	--	5	5	--	--	5	0	3	0	0	--	0	0	0	1	--	--	--	--	--	Poland	2014	[89]
27	27	--	0	--	--	--	--	--	--	--	--	--	--	--	100	--	--	--	--	10	--	22	--	--	--	Portugal	2012	[195]
170	54	--	66.7	--	--	--	--	--	--	--	--	--	--	--	29.6	--	--	--	--	59.3	--	51.9	--	--	0	Slovenia	2013	[3]
100	77	--	10	--	--	--	--	--	--	--	--	--	--	--	0	--	--	--	--	6	--	6	--	--	--	Sweden	2010	[76]
46	7[*1]	--	7	--	--	--	--	--	--	--	--	7	--	--	7	--	--	0	--	0	--	0	--	--	--	Sweden (imported from Denmark)	2010-2011	(50)
28	23	--	100	--	--	--	--	--	--	--	--	100	--	--	100	--	--	0	--	52.2	--	52.2	--	--	--	Sweden (imported from Germany)	2010-2011	(50)
9	1[*1]	--	1	--	--	--	--	--	--	--	--	1	--	--	1	--	--	0	--	0	--	0	--	--	--	Sweden (imported from Finland)	2010-2011	(50)
7	3[*1]	--	3	--	--	--	--	--	--	--	--	3	--	--	3	--	--	0	--	2	--	2	--	--	--	Sweden (imported from other EU countries)	2010-2011	(50)
40	38	--	100	--	--	--	--	--	--	--	--	100	--	--	100	--	--	0	--	73.7	--	73.7	--	--	--	Sweden (imported from Brazil)	2010-2011	(50)
3	3[*1]	--	3	--	--	--	--	--	--	--	--	3	--	--	3	--	--	0	--	3	--	3	--	--	--	Sweden (imported from Argentina, Chile)	2010-2011	(50)
97	92	--	18	--	--	--	--	--	--	--	--	--	--	--	0	--	--	--	--	4	--	4	--	--	--	Sweden	2012	[178]
4	10	10	80	--	--	80	--	--	--	--	--	--	--	--	70	--	--	--	--	--	--	50	--	--	--	Switzerland (domestic)	2012	[196]
5	6[*1]	1	5	--	--	5	--	--	--	--	--	--	--	--	3	--	--	--	--	--	--	1	--	--	--	Switzerland (imported from	2012	[196]

Number of food sampels	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS			2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS					4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)-QUINOLONES			MACROLIDES		POLYMYXINS	Country	Year	References
		% AMC	% AMP	% PEN	% PIP	% CEF	% CFR	% CFZ	% CEC	% CXM	% FOX	% CAZ	% CPD	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% AZM	% ERY	% CST			
																										France)		
5	8[*1]	7	8	--	--	8	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	7	--	--	--	Switzerland (imported from Hungary)	2012	[196]
75	68																	0								Switzerland	2013	[91]
100	82	--	--	--	--	--	--	--	--	87.8	18.3	100	97.6	--	100	--	0	0	--	--	--	--	--	--	--	Turkey	2012	[197]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **AZM**- azithromycin; **CAZ**- ceftazidime; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFR**- cefadroxil; **CFZ**- cephazolin; ; **CIP**- ciprofloxacin; **CPD**- cefpodoxime; **CST**- Colistin**;** **CRO**- ceftriaxone; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **ENR**- enrofloxacin; **ERY**- erythromycin; **FEP**- cefepime; **FOX**- cefoxitin; **IPM**- imipenem; **MEM**- meropenem; **NAL**- nalidixic acid; **PEN**- penicillin (generic); **PIP**- piperacillin; **TIO-** Cefiofur

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.1: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from turkey meat

Note: No data were available for the UK in eligible studies

Number of food sampels	Number of isolates	PENICILLINS				1ST GEN CEPHALO-SPORINS			2ND GEN CEPHALO-SPORINS			3RD GEN CEPHALO-SPORINS					4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)-QUINOLONES			MACROLIDES		POLYMYXINS	Country	Year	References
		% AMC	% AMP	% PEN	% PIP	% CEF	% CFR	% CFZ	% CEC	% CXM	% FOX	% CAZ	% CPD	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% ENR	% NAL	% AZM	% ERY	% CST			
37	37	--	19	--	--	5	--	--	--	--	--	--	--	--	--	0	--	--	--	3	--	8	--	--	--	Denmark (domestic)	2002	[16]
26	26	--	27	--	--	12	--	--	--	--	--	--	--	--	--	0	--	--	--	4	--	8	--	--	--	Denmark (imported)	2002	[16]
9	9[*1]	0	2	--	--	1	--	--	--	--	--	--	1	--	--	1	--	--	--	2	--	1	--	--	--	Denmark (domestic)	2006	[20]
475	475	1	65	--	--	11	--	--	--	--	--	--	1	--	--	0	--	--	--	21	--	20	--	--	--	Denmark (imported)	2006	[20]
N/S	3[*1]	--	3	--	--	--	--	--	--	--	--	3	--	--	3	--	--	--	--	3	--	3	--	--	--	Germany	2003-2012	[198]
N/S	46	--	76.1	--	--	--	--	--	--	--	--	2.2	--	--	2.2	--	--	--	--	39.1	--	37	--	--	--	The Netherlands	2010-2011	[73]
N/S	54	--	72.2	--	--	--	--	--	--	--	--	3.7	--	--	3.7	--	--	--	--	37	--	37	--	--	--	The Netherlands	2013	[88]
N/S	44	--	65.9	--	--	--	--	--	--	--	--	6.8	--	--	2.3	--	--	--	0	36.4	--	22.7	4.5	--	4.5	The Netherlands	2014	[74]
170	154	--	23.4	--	--	--	--	--	--	--	--	--	--	--	0	--	--	--	--	1.3	--	1.3	--	--	--	Norway	2013	[3]
154	154	--	23.4	--	--	--	--	--	--	--	--	0	--	--	0	--	--	--	--	1.2	--	1.2	--	--	--	Norway	2013	[199]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **AZM**- azithromycin; **CAZ**- ceftazidime; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFR**- cefadroxil; **CFZ**- cephazolin; ; **CIP**- ciprofloxacin; **CPD**- cefpodoxime; **CST**- Colistin; **CRO**- ceftriaxone; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **ENR**- enrofloxacin; **ERY**- erythromycin; **FEP**- cefepime; **FOX**- cefoxitin; **IPM**- imipenem; **MEM**- meropenem; **NAL**- nalidixic acid; **PEN**- penicillin (generic); **PIP**- piperacillin; TIO- Cefiofur

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.2: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from poultry meat

Note: resistance to macrolides and polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS	1ST GEN CEPHALO-SPORINS	3RD GEN CEPHALO-SPORINS	(FLUORO)-QUINOLONES	Country	Year	References

		% AMC	% AMP	% CEF	% CFZ	% CAZ	% CIP	% NAL			
73	119	--	76.5	56.3	--	--	77.3	--	Mexico	2008	[37]
195	175	3	15	--	10	2	1.5	4	United States	2001-2003	[200]
195	175	18	63	--	26	17	1.5	26	United States	2001-2003	[200]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CAZ**- ceftazidime; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CFZ**- cephazolin; **NAL**- nalidixic acid

Table 3.1: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from chicken meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS				4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% AMX	% CEF	% CFZ	% FOX	% CAZ	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% NAL	% AZM	% MIC			
8	3[*1]	3	--	--	--	--	--	--	3	3	3	2	--	--	2	2	--	--	Brazil	2011 -2013	[201]

Number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS				4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% AMX	% CEF	% CFZ	% FOX	% CAZ	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% NAL	% AZM	% MIC			
75	43	--	1	--	1	--	1	--	1	--	97.7	--	--	--	0	--	--	--	Canada	2002	[8]
267	248	30	--	44	35	--	33	--	0	--	25	--	--	--	0	1	--	--	Canada	2003	[35]
206	193	31.1	43	--	--	--	30.1	--	28.5	--	22.3	--	--	--	0	4.1	--	--	Canada	2007-2008	[202]
43	42	33.4	59.5	--	--	--	33.3	--	0	--	28.5	--	--	--	0	4.8	--	--	Canada (British Columbia)	2007	[92]
78	70	52.9	62.9	--	--	--	54.3	--	54.3	--	48.6	--	--	--	0	4.3	--	--	Canada (British Columbia)	2008	[36]
74	70	48.6	61.4	--	--	--	48.6	--	47.1	--	41.4	--	--	--	0	7.1	--	--	Canada (British Columbia)	2009	[93]
84	75	48	62.7	--	--	--	50.7	--	48	--	44	--	--	--	0	6.7	--	--	Canada (British Columbia)	2010	[94]
83	74	43.2	59.5	--	--	--	40.5	--	40.5	--	39.2	--	--	--	0	4.1	0.8	--	Canada (British Columbia)	2012	[95]
N/S	65	61.5	73.8	--	--	--	61.5	--	60	--	58.5	--	--	--	0	3.1	0.9	--	Canada (British Columbia)	2013	[126]
56	37	27	29.7	--	--	--	24.3	--	27	--	18.9	--	--	--	0	0	--	--	Canada (Maritimes region)	2008	[36]
199	185	27.6	42.2	--	--	--	26.5	--	27	--	27	--	--	--	0	3.8	--	--	Canada (Maritimes region)	2009	[93]
190	175	21.1	40	--	--	--	21.7	--	21.1	--	17.7	--	--	--	0	3.4	1.3	--	Canada (Maritimes region)	2010	[94]
N/S	136	24.2	35.3	--	25.8	--	22.1	--	0	--	17.7	--	--	--	0	1.5	--	--	Canada (Ontario)	2003	[35]
N/S	150	29.4	39.3	--	30.7	--	26.7	--	0	--	21.3	--	--	--	0	0.7	--	--	Canada (Ontario)	2004	[96]
153	145	24.8	33.1	--	--	--	23.4	--	0	--	17.2	--	--	--	0	0.7	--	--	Canada (Ontario)	2005	[97]
156	152	28.9	42.1	--	--	--	28.9	--	0	--	22.4	--	--	--	0	3.3	--	--	Canada (Ontario)	2006	[98]
161	157	26.8	38.9	--	--	--	25.5	--	0.6	--	22.3	--	--	--	0	3.2	--	--	Canada (Ontario)	2007	[92]
156	150	27.3	39.3	--	--	--	28	--	28	--	24	--	--	--	0	4	--	--	Canada (Ontario)	2008	[36]
164	155	23.2	40.6	--	--	--	22.6	--	22.6	--	21.3	--	--	--	0	3.2	--	--	Canada (Ontario)	2009	[93]
116	100	24	39	--	--	--	24	--	24	--	21	--	--	--	0	2	0	--	Canada (Ontario)	2010	[94]
116	107	19.6	43.9	--	--	--	19.6	--	18.7	--	18.7	--	--	--	0	1.9	0	--	Canada (Ontario)	2012	[95]

Number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS				4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% AMX	% CEF	% CFZ	% FOX	% CAZ	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% NAL	% AZM	% MIC			
N/S	114	23.7	36.8	--	--	--	23.7	--	23.7	--	21.9	--	--	--	0	1.8	0	--	Canada (Ontario)	2013	[126]
84	81	13.6	24.7	--	--	--	9.9	--	0	--	3.7	--	--	--	0	4.9	--	--	Canada (Saskatchewan)	2005	[97]
86	85	9.4	30.6	--	--	--	9.4	--	0	--	5.9	--	--	--	0	3.5	--	--	Canada (Saskatchewan)	2006	[98]
77	75	17.3	34.7	--	--	--	16	--	0	--	13.3	--	--	--	0	5.3	--	--	Canada (Saskatchewan)	2007	[92]
92	91	20.9	40.7	--	--	--	20.9	--	20.9	--	19.8	--	--	--	0	6.6	--	--	Canada (Saskatchewan)	2008	[36]
92	90	25.6	35.6	--	--	--	23.3	--	23.3	--	22.2	--	--	--	0	4.4	--	--	Canada (Saskatchewan)	2009	[93]
79	71	22.5	35.2	--	--	--	19.7	--	22.5	--	19.7	--	--	--	0	9.9	--	--	Canada (Saskatchewan)	2010	[94]
71	64	23.4	28.1	--	--	--	23.4	--	21.9	--	21.9	--	--	--	0	7.8	0	--	Canada (Saskatchewan)	2012	[95]
N/S	62	21	33.9	--	--	--	19.4	--	21	--	19.4	--	--	--	0	8.1	0	--	Canada (Saskatchewan)	2013	[126]
N/S	112	42	50	--	46.4	--	43.8	--	0	--	33	--	--	--	0	0	--	--	Canada (Quebec)	2003	[35]
N/S	158	42.4	51.9	--	46.8	--	43	--	0.6	--	34.2	--	--	--	0	5.1	--	--	Canada (Quebec)	2004	[96]
150	142	--	--	--	--	--	32.4	--	0	--	24.6	--	--	--	0	2.1	--	--	Canada (Quebec)	2005	[97]
144	135	8.1	34.8	--	--	--	7.4	--	0	--	5.9	--	--	--	0	0.7	--	--	Canada (Quebec)	2006	[98]
144	128	17.9	34.4	--	--	--	17.2	--	0	--	13.3	--	--	--	0	3.1	--	--	Canada (Quebec)	2007	[92]
144	131	22.1	32.8	--	--	--	19.8	--	21.4	--	18.3	--	--	--	0	8.4	--	--	Canada (Quebec)	2008	[36]
134	126	23	41.3	--	--	--	23	--	21.4	--	19	--	--	--	0	3.2	--	--	Canada (Quebec)	2009	[93]
148	138	30.4	54.3	--	--	--	30.4	--	31.2	--	26.8	--	--	--	0	0.7	0	--	Canada (Quebec)	2010	[94]
140	128	26.6	43.8	--	--	--	26.6	--	26.6	--	25	--	--	--	0	1.6	0	--	Canada (Quebec)	2012	[95]
N/S	117	24.8	53.8	--	--	--	24.8	--	24.8	--	23.9	--	--	--	0	4.3	0	--	Canada (Quebec)	2013	[126]
1,003	265	--	61	--	--	--	--	--	--	30	--	--	--	--	28	--	--	--	Colombia	2008-2013	[127]
600	580	--	49	--	--	--	--	--	--	30	--	--	--	--	30	--	--	--	Colombia	2008-2013	[127]

Number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS				4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% AMX	% CEF	% CFZ	% FOX	% CAZ	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% NAL	% AZM	% MIC			
200	165	8.5	--	40	59.3	--	9.1	4.8	17	20	16.4	1.5	0	0	32.1	64	--	94.5	Colombia	2009	[181]
51	58	--	55	--	56	--	--	--	2	--	4	--	--	--	0	16	--	--	United States	1999	[100]
212	115	--	32	--	38	--	--	--	2	--	6	--	--	--	0	8	--	--	United States	1999	[100]
50	9[^1]	0	1	--	--	1	--	0	--	--	--	--	--	--	0	0	--	--	United States	1999	[101]
169	150	--	--	--	--	--	--	--	--	--	--	--	--	--	0.7	41.3	--	--	United States	2000	[203]
N/S	282	12.1	21.6	--	--	--	11	--	7.8	--	7.1	--	--	--	0	2.8	--	--	United States	2002	[14]
N/S	396	13.6	25.3	--	--	--	9.3	--	9.1	--	7.6	--	--	--	0	4	--	--	United States	2003	[14]
N/S	400	10	17	--	--	--	8.3	--	6.5	--	5.8	--	--	--	0	7	--	--	United States	2004	[14]
N/S	393	12.2	24.7	--	--	--	11.2	--	10.2	--	8.7	--	--	--	0	6.6	--	--	United States	2005	[14]
415	415	12	18	--	--	--	20	--	20	--	8	--	--	--	0	11	--	--	United States	2006	[102]
N/S	418	11.5	20.1	--	--	--	11.2	--	9.1	--	8.6	--	--	--	0	5	--	--	United States	2006	[14]
N/S	299	7.4	18.1	--	--	--	7.4	--	6.4	--	6	--	--	--	0	3	--	--	United States	2007	[14]
N/S	306	11.8	23.5	--	--	--	11.8	--	11.1	--	10.8	--	--	--	0	2.9	--	--	United States	2008	[14]
N/S	315	13.3	22.2	--	--	--	13.3	--	12.4	--	11.7	--	--	--	0.3	2.9	--	--	United States	2009	[14]
N/S	357	6.7	16.5	--	--	--	6.7	--	6.4	--	5.6	--	--	--	0.3	3.6	--	--	United States	2010	[14]
N/S	341	14.1	26.4	--	--	--	13.2	--	12.6	--	12.3	--	--	--	0	2.3	0	--	United States	2011	[14]
231	121	76.9	57.9	--	--	--	93.4	0	88.4	--	90.1	--	--	--	97.5	97.5	--	--	United States	2012	[133]
N/S	386	7.8	0.3	--	--	--	7.8	--	7.8	--	7.5	--	--	--	0	1.8	0	--	United States	2012	[14]
N/S	360	5.6	20.8	--	--	--	5	--	4.4	--	4.4	--	--	--	0.6	2.5	0	--	United States	2013	[14]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **AZM**- azithromycin; **CAZ**- ceftazidime; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CFZ**- cephazolin; **CRO**- ceftriaxone; **CTX**- cefotaxime; **FEP**- cefepime; **FOX**- cefoxitin; **IPM**- imipenem; **MEM**- meropenem; **MIC**- tilmicosin; **NAL**- nalidixic acid; **TIO**- Cefiofur

[^1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.1: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from turkey meat

Number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS				4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% AMX	% CEF	% CFZ	% FOX	% CAZ	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% NAL	% AZM	% MIC			
434	1,281	2.9	10.9	--	3.8	--	3.5	--	0	--	2.4	--	--	--	0	0.1	--	--	Canada	2003-2004	(175)
91	78	10.3	24.3	--	--	--	10.3	--	10.3	--	10.3	--	--	--	0	3.8	--	--	Canada	2007-2008	[202]
N/S	101	15.8	30.7	--	--	--	14.9	--	13.9	--	12.9	--	--	--	0	2	0	--	Canada (British Columbia)	2012	[95]
N/S	67	7.5	28.4	--	--	--	3	--	4.5	--	3	--	--	--	0	3	0	--	Canada (British Columbia)	2013	[126]
N /S	152	11.2	30.9	--	--	--	10.5	--	9.2	--	8.6	--	--	--	0.7	2	0	--	Canada (Ontario)	2012	[95]
N/S	119	3.4	25.2	--	--	--	3.4	--	2.5	--	2.5	--	--	--	0	0.8	--	--	Canada (Ontario)	2013	[126]
N/S	81	4.9	24.7	--	--	--	3.7	--	3.7	--	3.7	--	--	--	0	2.5	0	--	Canada (Saskatchewan)	2012	[95]
N/S	59	3.4	27.1	--	--	--	3.4	--	3.4	--	3.4	--	--	--	0	1.7	--	--	Canada (Saskatchewan)	2013	[126]
N /S	170	12.4	37.6	--	--	--	11.8	--	11.2	--	11.2	--	--	--	0	0	0	--	Canada (Quebec)	2012	[95]
N/S	107	5.6	31.8	--	--	--	5.6	--	6.5	--	5.6	--	--	--	0	0	--	--	Canada (Quebec)	2013	[126]
194	33	--	22	--	30	--	--	--	0	--	6	--	--	--	0	12	--	--	United States	1999	[100]
50	54	--	26	--	38	--	--	--	0	--	0	--	--	--	0	0	--	--	United States	1999	[100]

Number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS				4RD GEN CEPHALOSPORINS	CARBAPENEMS		(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
		% AMC	% AMP	% AMX	% CEF	% CFZ	% FOX	% CAZ	% CRO	% CTX	% TIO	% FEP	% IPM	% MEM	% CIP	% NAL	% AZM	% MIC			
50	28	4	46	--	--	36	--	4	--	--	--	--	--	--	0	25	--	--	United States	1999	[101]
N/S	304	5.6	31.3	--	--	--	3.3	--	1.3	--	1	--	--	--	0	4.3	--	--	United States	2002	[14]
N/S	333	3	35.7	--	--	--	1.2	--	0.3	--	0.3	--	--	--	0.3	11.7	--	--	United States	2003	[14]
N/S	376	5.3	33.2	--	--	--	4.5	--	1.3	--	1.1	--	--	--	0.8	10.6	--	--	United States	2004	[14]
N/S	396	3.8	38.1	--	--	--	3.3	--	2.3	--	1.8	--	--	--	0	10.4	--	--	United States	2005	[14]
959	242	13.6	47.1	--	--	--	11.2	--	0	--	0	--	--	--	0.4	8.7	--	--	United States	2006	[204]
387	387	--	--	--	--	--	5	--	2	--	2	--	--	--	1	10	--	--	United States	2006	[102]
N/S	388	6.7	42	--	--	--	6.2	--	3.1	--	3.1	--	--	--	0.5	5.2	--	--	United States	2006	[14]
N/S	315	6.3	48.3	--	--	--	6.3	--	6	--	6	--	--	--	0.3	2.2	--	--	United States	2007	[14]
N/S	300	8.3	58	--	--	--	6.3	--	3.7	--	3.7	--	--	--	0	3.7	--	--	United States	2008	[14]
N/S	306	9.8	56.2	--	--	--	7.8	--	6.9	--	6.2	--	--	--	0.7	2.6	--	--	United States	2009	[14]
N/S	369	10	52.6	--	--	--	9.2	--	8.9	--	7.9	--	--	--	0.5	2.7	--	--	United States	2010	[14]
N/S	368	13	51.6	--	--	--	12.5	--	10.1	--	9.8	--	--	--	0	1.6	0	--	United States	2011	[14]
N/S	391	11.8	55.5	--	--	--	11.3	--	9.7	--	9.2	--	--	--	0.3	0.3	0	--	United States	2012	[14]
N/S	374	8.8	54	--	--	--	7.8	--	6.7	--	6.4	--	--	--	0.3	1.9	0	--	United States	2013	[14]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **AZM**- azithromycin; **CAZ**- ceftazidime; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CFZ**- cephazolin; **CRO**- ceftriaxone; **CTX**- cefotaxime; **FEP**- cefepime; **FOX**- cefoxitin; **IPM**- imipenem; **MEM**- meropenem; **MIC**- tilmicosin; **NAL**- nalidixic acid; **TIO**- Cefiofur

Table 3.2: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from poultry meat

Note: resistance to macrolides and polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS	3RD GEN CEHALOSPORINS	(FLUOROJQUINOLONES	Country	Year	References
		% AMC	% CTX	% NAL			
N/S	1[*1]	--	1	--	Egypt	2012-2013	[205]
152	46	100	--	--	Nigeria	2011	[206]
152	46	--	--	59	Nigeria	2011	[206]

AMC- amoxicillin-clavulanic acid; **CTX**- cefotaxime; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.3: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from chicken meat

Note: resistance to polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS			CARBAPENEMS		(FLUORO)QUINOLONES			MACROLIDES	Country	Year	References
		% AMC	% AMP	% AMX	% PEN	% CEF	% CFR	% CTT	% CXM	% FOX	% CAZ	% CRO	% CTX	% IPM	% MEM	% CIP	% ENR	% NAL	% ERY			
N/S	1[*1]	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Egypt	2012-2013	[205]
100	38	--	--	--	--	--	--	--	--	--	--	--	--	0	0	--	--	--	--	Egypt	2013	[32]
100	38	--	--	--	--	--	--	--	--	--	26.3	26.3	26.3	--	--	--	--	--	--	Egypt	2013	[32]
N/S	1[*1]	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	Egypt	2012-2013	[205]
87	1[*1]	--	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	--	--	Ghana	2001	[207]
87	2[*1]	--	2	2	0	--	2	--	--	--	--	--	--	--	--	--	--	--	--	Ghana	2001	[207]
87	2[*1]	--	2		2	--	2	--	--	--	--	--	--	--	--	--	--	--	--	Ghana	2001	[207]
151	17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	47.1	--	--	--	Gabon	2011	[208]
151	17	--	--	--	--	--	--	--	88	--	41.2	--	71	0	0	--	--	--	--	Gabon	2011	[208]

Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS			3RD GEN CEPHALOSPORINS			CARBAPENEMS		(FLUORO)QUINOLONES			MACROLIDES	Country	Year	References
		% AMC	% AMP	% AMX	% PEN	% CEF	% CFR	% CTT	% CXM	% FOX	% CAZ	% CRO	% CTX	% IPM	% MEM	% CIP	% ENR	% NAL	% ERY			
N/S	73	12.3	61.6	--	--	--	--	--	--	--	--	--	--	--	0	26	--	26	--	Ghana (imported meat)	N/S	[209]
N/S	36	0	69.4	--	--	--	--	--	--	--	--	--	--	--	0	27.8	--	27.8	--	Ghana (domestic production)	N/S	[209]
87	1[*1]	--	--	--	--	--	--	--	--	--	--	0	--	--	--	--	--	1	1	Ghana	2001	[207]
87	2[*1]	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--	--	0	2	Ghana	2001	[207]
2	1[*1]	--	0	--	--	--	--	--	--	0	0	--	0	--	--	0	--	1	--	Tunisia	2004-2005	[210]
7	9[*1]	--	0	--	--	--	--	--	--	0	0	--	0	--	--	4	--	9	--	Tunisia	2004-2005	[210]
2	3[*1]	--	1	--	--	--	--	--	--	0	0	--	0	--	--	0	--	1	--	Tunisia	2004-2005	[210]
3	1[*1]	--	1	--	--	--	--	--	--	0	0	--	0	--	--	0	--	0	--	Tunisia	2004-2005	[210]
8	6[*1]	--	4	--	--	--	--	--	--	0	0	--	0	--	--	6	--	6	--	Tunisia	2004-2005	[210]
100	82	23.2	100	--	--	100	--	2.4	--	--	--	--	--	--	--	--	--	--	--	Turkey	2012	[197]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **CAZ**- ceftazidime **CEF**- cephalothin; **CFR**- cefadroxil; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **ENR**- enrofloxacin; **ERY**- erythromycin; **IPM**- imipenem; **FOX**- cefoxitin; **MEM**- meropenem; **NAL**- nalidixic acid; **PEN**- penicillin (generic)

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.4: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from turkey meat

Note: resistance to macrolides and polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS	2ND GEN CEPHALOSPORINS	3RD GEN CEHALOSPORINS		(FLUORO)QUINOLONES		Country	Year	References
		% AMP	% FOX	% CAZ	% CTX	% CIP	% NAL			
2	1[*1]	0	0	0	0	0	1	Tunisia	2004-2005	[210]
8	2[*1]	0	0	0	0	2	2	Tunisia	2004-2005	[210]

AMP- ampicillin; **CAZ**- ceftazidime; **CIP**- ciprofloxacin; **CTX**- cefotaxime; **FOX**- cefoxitin; **NAL**- nalidixic acid.

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.5: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from poultry meat

Note: resistance to macrolides and polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS	2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS		(FLUORO)QUINOLONES		Country	Year	References
		% AMP	% FOX	% CAZ	% CTX	% CIP	% NAL			
143	84	100	1	22	100	83	88	Vietnam	2013	[107]

AMP- ampicillin; **CAZ**- ceftazidime; **CIP**- ciprofloxacin; **CTX**- cefotaxime; **FOX**- cefoxitin; **NAL-** nalidixic acid

Table 3.6: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from chicken meat

Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS		3RD GEN CEPHALOSPORINS					CARBAPENEMS	(FLUORO)QUINOLONES			MACROLIDES	POLYMYXINS	Country	Year	References
		% AMC	% AMP	% AMX	% PIP	% CEF	% CFD	% CTT	% FOX	% CAZ	% CPD	% CFP	% CRO	% CTX	% MEM	% CIP	% ENR	% NAL	% ERY	% CST			
576	398	69	71	--	--	--	0.136		8	--	--	--	--	--	--	30	--	74	--	--	China	2010	[211]
59	50	--	60	--	--	40	--	--	--	--	--	--	--	--	--	--	--	--	--	--	China	2012-2013	[104]
214	214	--	--	--	--	--	--	--	--	--	--	--	--	37.4	--	37.4	--	--	--	--	China	2011	[103]
59	50	--	--	--	--	--	--	--	--	1	--	--	10	--	--	12	--	--	--	--	China	2012-2013	[104]
69	69	--	73.9	--	--	36.2	--	26.1	23.2	13	2.9	--	4.3	5.8	--	30.4	--	47.8	--	--	Japan	2009	[212]
26	31	--	--	--	74	--	--	--	--	48	--	--	--	94	--	9	--	--	--	--	Japan (domestic)	2010	[213]
42	21	--	--	--	1	--	--	--	--	19	--	--	--	1	--	10	--	--	--	--	Japan (imported from South America)	2010	[213]
131	N/S	--	96.2	--	--	--	93.9	--	--	--	--	83.3	--	--	--	78	72	94.7	84	--	Malaysia	2005	[214]
100	88	--	95.4	--	--	--	--	--	--	--	--	--	--	26.2	--	30.8	--	81.5	--	--	Pakistan	2015	[215]
119	37	--	78.4	--	--	13.5	--	--	--	--	--	--	--	--	--	--	--	70.3	--	--	Saudi Arabia	2009	[216]
30	19	15.8	84.2	84.2	--	31.6	--	--	--	--	--	--	--	--	--	52.6	--	68.4	--	--	Vietnam	2004	[105]
30	6[*1]	1	6	6	--	2	--	--	--	--	--	--	--	--	--	2	--	4	--	--	Vietnam	2004	[56]
30	19	15.8	84.2	84.2	--	31.6	--	--	--	--	--	--	--	--	--	52.6	63.2	68.4	--	--	Vietnam	2004	[105]
143	143	--	100	--	--	--	--	--	2	24	--	--	--	100	0	88	--	88	--	--	Vietnam	2013	[106]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **CAZ**- ceftazidime; **CEF**- cephalothin; **CFD**- cephadrine; **CIP**- ciprofloxacin; **CPD**- cefpodoxime; **CRO**- ceftriaxone; **CST**- colistin; **CTT**- cefotetan; **CTX**- cefotaxime; **ENR-** enrofloxacin; **ERY**- erythromycin; **FOX**- cefoxitin; **MEM**- meropenem; **NAL-** nalidixic acid; **PIP**- piperacillin

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.7: Australia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from chicken meat

Note: resistance to macrolides and polymyxins was not explored in eligible studies.

Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES	Country	Year	References
		% AMX	% CIP			
30	9[*1]	9	1	Australia	2010	[217]

AMX- amoxicillin; **CIP**- ciprofloxacin

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

MDR phenotypes in Escherichia coli

Table 3.8: UK & Europe- MDR phenotypes observed in *E. coli* isolates from poultry meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
29	7	AMC, AMP, CIP, CHL, KAN, NAL, TET, TMP (n= 1); AMC, AMP, NAL, TET (n= 1); AMP, CIP, NAL, STR, TMP (n= 1); AMP, CIP, NAL, STR (n= 1); AMC, AMP, CIP, CHL, GEN, NAL, STR, SXT, TET, TMP (n= 2); AMP, CTX, SXT, TMP (n= 1).	Czech Republic	2012-2013	[85]
N/S	68	ESBLs producers (1.5% were resistant also to CST)	The Netherlands	2009	[218]
468	95	ESBL producers	The Netherlands	2010-2011	[73]
N/S	119	ESBLs producers (1.7% were resistant also to CST)	The Netherlands	2014	[219]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.9: UK & Europe- MDR phenotypes observed in *E. coli* isolates from chicken meat

Note: No data were available for the UK in eligible studies

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Chicken meat	62	1	ESBL-producers	**United Kingdom (domestic production)**	2006	[220]
Chicken meat	10	4	ESBL-producers	**United Kingdom (imported from Brazil)**	2006	[220]
Chicken meat	4	3	ESBL-producers	**United Kingdom (imported from Brazil, Poland and Poland)**	2006	[220]
Chicken meat	3	0	ESBL-producers	**United Kingdom (imported from RoI)**	2006	[220]
Chicken meat	4	0	ESBL-producers	**United Kingdom (imported from Poland)**	2006	[220]
Chicken meat	4	0	ESBL-producers	**United Kingdom (imported from Spain, France, Denmark and Germany)**	2006	[220]
Chicken meat	2	2	ESBL-producers	**United Kingdom (imported from The Netherlands)**	2006	[220]
Chicken meat	40	7	ESBL-producers	**United Kingdom (imported, country**	2006	[220]

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
				unknown)		
Chicken meat	26	26	ESBLs-producers. Two of the ESBL isolates presented the following phenotypes: CAZ, CHL, FOX, MXF, NAL, SXT, TET (n=1) FEP (n= 1)	Austria	2001-2003	[190]
Chicken meat	75	N/S	AMC, AMP, CHL, CIP, SXT	Czech Republic	2015	[191]
Chicken meat	N/S	5	5 ESBL-producers expressing mcr-1: CST, PMB, TIM, CTX, CAZ, ATM; CST, PMB, CTX, CAZ, ATM, TMPS; CST, PMB, CTX, CAZ, ATM; CST, PMB, TIM, CTX, CAZ, ATM, TMPS CST, PMB, TIM, CIP, LEV, DOX, MIN, TMPS	Denmark	2012-2014	[221]
Chicken meat	197	N/S	CAZ, CTX	Denmark	2012	[66]
Chicken meat	116	N/S	CAZ, CTX	Denmark	2013	[3]
Chicken (liver)	2	2	AMP, CHL, TET	Germany (imported from Italy)	2003	[222]
Chicken (thigh)	11	9	AMP, CIP, CHL; AMP, CIP, CHL, TET, TMP; AMP, CIP, TET, TMP; AMP, CHL, TET, (n= 2); AMP, CHL, CIP, COL, TET; AMP, CHL, TET, TMP; AMP, CHL, CIP, TMP; AMP, CIP, TET, TMP	Germany (imported from Italy)	2003	[222]
Chicken (breast fillet)	5	5	AMP, CHL, CIP, TET, TMP; AMP, CHL, CIP, TET; AMP, CHL, TET, TMP; AMP, CHL, CIP, TET; AMP, CHL, CIP, TET, TMP	Germany (imported from Italy)	2003	[222]
Chicken (gizzard)	3	3	AMP, CHL, CIP, TET, TMP; AMP, CHL, CIP	Germany (imported from Italy)	2003	[222]
Chicken (breast)	1	1	AMP, CHL, TET	Germany (imported from Italy)	2003	[222]
Chicken (heart)	2	2	AMP, CHL, CIP, TET, TMP; AMP, CHL, CIP, COL, TET, TMP	Germany (imported from Italy)	2003	[222]
Chicken (fresh)	75	N/S	AMP, CIP, ENX, NAL, SXT, TET	Iceland	2006-2007	[86]
Chicken meat	89	68	ESBL	Netherlands	N/S	[223]
Chicken meat (conventional farming)	60	60	ESBL	Netherlands	2010	[193]
Chicken (organic farming)	30	25	ESBL	Netherlands	2010	[193]
Chicken meat	98	11	ESBL	Netherlands	2013	[74]
Chicken meat	118	112	ESBL	Netherlands	2013	[74]

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
				(imported)		
Chicken meat	376	252	ESBL	Netherlands	2014	[88]
Chicken meat	38	32	ESBL	Netherlands	2014	[88]
Chicken meat	197	N/S	ESBL	Norway	2012	[66]
Chicken meat	27	23	ESBL	Portugal	2012	[195]
Chicken meat	13	7	ESBL-producers	Poland	2012-2013	[108].
Chicken meat	13	12	ESBL-producers (n= 7); AMP, ESBL-producers (n= 5)	Poland	2014	[89]
Chicken meat	54	16	ESBL-producers	Slovenia	2013	[3]
Chicken meat	52	N/S	AMC, AMK, CIP, CXM, ETP, FEP, FOF, FOX, NAL, TZP, TOB, GEN	Spain	2007	[188]
Chicken meat	8	4	ESBL-producers	Spain	2009	[224]
Chicken meat	62	N/S	AMC, AMK, CIP, CXM, ETP, FEP, FOF, FOX, GEN, NAL, TOB, TZP	Spain	2010	[188]
Chicken meat	12	8	ESBL-producers	Spain	2006-2007	[109]
Chicken meat	37	N/S	ESBL-producers	Switzerland	2013	[91]
Chicken meat	23	N/S	ESBL-producers	Switzerland	2013	[91]
Chicken meat	10	8	AMX, CHL, CTX, NAL, SXT, TMP (n= 3); AMX, CHL, CTX, NAL, SXT, TET (n= 1); AMX, CHL, CTX, GEN, TET, NAL, SXT (n= 1); AMX, CHL, CTX, TET, SXT (n= 2); AMX, AMC, CHL, GEN, TET, STR, SXT, TMP (n= 1)	Switzerland	2012	[196]
Chicken meat	6	5	AMX, CHL, SXT, TET (n= 1); AMX, CHL, CTX, NAL, SXT, TET (n= 2); AMX, CHL, CTX, GEN, SXT, TET (n= 1); AMC, AMX, CHL (n= 1)	Switzerland (imported from France)	2012	[196]
Chicken meat	8	8	AMC, AMX, CHL, GEN, STR, NAL, SXT (n= 1); AMC, AMX, CHL, NAL, TET, (n= 3); AMC, AMX, CHL (n= 1); AMX, CHL, CTX, NAL, SXT, TET (n= 1); AMC, AMX, CHL, GEN, NAL, STR, SXT, TET, TMP (n= 1); AMC, AMX, CHL, NAL, KAN, STR (n= 1)	Switzerland (imported from Hungary)	2012	[196]
Chicken meat	77	2	AMP, STR, SXT, TMP (n= 1); AMP, CHL, CIP, ENR, NAL (n= 1)	Sweden	2010	[76]
Chicken meat	92	9	ESBL-producers	Sweden (imported from Denmark)	2012	[178]
Chicken meat	7	7	AmpC and ESBL-producers	Sweden (imported from Germany)	2010-2011	[24]
Chicken meat	23	22	AmpC and ESBL-producers	Sweden (imported from Finland)	2010-2011	[24]

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Chicken meat	1	1	AmpC and ESBL-producers	Sweden (imported from other EU countries)	2010-2011	[24]
Chicken meat	6	3	ESBL-producers (no AmpC producers detected): CIP, NAL, STR, SXT; CIP, NAL, KAN, SXT, TET; CHL, KAN, STR, SXT, TET	Sweden (imported from other EU countries)	2010-2011	[24]
Chicken meat	38	38	ESBL-producers (no AmpC-producers detected)	Sweden (imported from Brazil)	2010-2011	[24]
Chicken meat	3	1	AmpC-producer	Sweden (imported from Argentina)	2010-2011	[24]
Chicken meat	68	42	Most comment phenotypes: 3GC, NAL, TMPS, TET (one isolate was also resistant to ciprofloxacin) No carbapenem resistant E. coli isolates were detected.,	Switzerland	2013	[91]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.10: UK & Europe- MDR phenotypes observed in *E. coli* isolates from turkey meat

Note: No data were available for the UK in eligible studies

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Turkey (liver)	2	2	AMP, CIP, TET; AMP, CHL, CIP, TMP	Germany (imported from Italy)	2003	[222]
Turkey (heart)	2	2	AMP, COL, TET; AMP, CHL, TET	Germany (imported from Italy)	2003	[222]
Turkey (breast)	2	2	AMP, CHL, CIP, GEN, TET, TMP	Germany (imported from Italy)	2003	[222]
Turkey (gizzard)	1	1	AMP, CHL, TET, TMP,	Germany (imported from Italy)	2003	[222]
Turkey (fresh meat)	3	2	AMP, CAZ, CTX, NAL, SXT; AMP, CAZ, CTX, NAL, STR, SXT, TET	Germany	2003-2012	[198]
Turkey	46	1	ESBL-producers	Netherlands	2010-2011	[73]
Turkey	21	16	ESBL-producers	Netherlands	2013	[74]
Turkey	19	11	ESBL-producers	Netherlands	2014	[88]
Turkey	7	4	ESBL-producers	Netherlands (imported)	2014	[88]
Turkey	12	7	ESBL-producers	Spain	2006-2007	[109]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.11: North, Central & South America- MDR phenotypes observed in *E. coli* isolates from poultry meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
51	51	antimicrobial resistance profile of isolates of ESBL/AmpC-producing *E. coli*: AMP, AMC, CFZ, CTX, TET, NAL; AMP, CFZ, CTX, GEN,TET, NAL; AMP, CFZ, CTX, GEN,TET, NAL, CIP, NOR, ENR, STX; AMP, CFZ, CTX, GEN, TET, NAL, CIP, STX; AMP, CFZ, CTX, GEN,TET, NAL, CIP, ENR; AMP, CFZ, CFX, GEN,TET, NAL; AMP, CFZ, CTX, CHL, GEN, NAL, STX;	Brazil	N/S	[225]

		AMP, CFZ, CTX, TET, NAL, CIP, NOR, ENR, STX; AMP, CFZ, CTX, TET, NAL, CIP, NOR, ENR, STX; AM, CFZ, CTX, CHL,TET, NAL; AMP, CFZ, CTX, GEN,TET, NAL, CIP, ENR, STX; AMP, CFZ, CTX, GEN,TET, NAL, ENR AMP, CFZ, CTX, GEN,TET, NAL; AMP, CFZ, CTX, GEN,TET, NAL, CIP, STX; AMP, AMC, CFZ, GEN,TET, NAL, STX; AMP, AMC, CFZ, CTX, GEN, TET, NAL; AMP, AMC, CFZ, CTX, GEN,TET, NAL, CIP, NOR, ENR, SXT; AMP, CFZ, CTX, GEN,TET, NAL (N= 2); AMP, CFZ, CTX, CHL,TET, NAL, CIP, NOR, SXT; AMP, CFZ, CTX, GENT, TET, NAL, CIP, ENR; AMP, AMC, CFZ, CTX, TET, NIT, NAL; AMP, AMC, CFZ, CTX, GEN, TET; AMP, AMC, CFZ, CTX, CHL, TET, NIT, NAL, CIP, NOR, ENR, SXT; AMP, CFZ, CFX, TET, ENR; AMP, CFZ, CTX, TET, NIT; AMP, AMC, CFZ, CTX, CHL,TET, NAL, SXT; AMP, CFZ, CTX, TET; AMP, CFZ, CTX, TET, NAL, CIP, NOR, ENR; AMP, CFZ, CTX, TET; AMP, CFZ, CTX, CHL,TET, NAL, CIP, NOR, ENR; AMP, CFZ, CTX, TET; AMP, CFZ, CTX, CAZ,TET; AMP, CFZ, CTX, TET, NIT; AMP, CFZ, CTX, TET, NAL, CIP, NOR, ENR; AMP, AMC, CFZ, CHL,GEN,TET, NIT, STX; AMP, AMC, CFZ, FOX, TET, NAL, STX; AMP, AMC, CFZ, FOX, GEN, TET, NAL, STX; AMP, AMC, CZ, FOX, CAZ, TET, NAL, STX AMP, AMC, CFZ, FOX, TET, NAL, STX; AMP, AMC, CFZ, FOX,CAZ,TET, NAL, CIP, NOR, ENR, STX; AMP, AMC, CFZ, FOX, TET, NAL, STX; AMP, AMC, CFZ, FOX, CHL, GEN, TET, NAL, CIP, NOR, ENR, STX; AMP, AMC, CFZ, FOX,CTX, TET, NAL, STX; AMP, AMC, CFZ, FOX, CAZ, TET, NAL, CIP, ENR, STX; AMP, AMC, CFZ, FOX, CAZ,TET, NIT, NAL, CIP, ENR; AMP, AMC, CFZ, CTX, CAZ, CHL, TET, NAL, CIP, NOR, ENR; AMP, CFZ, CTX, TET, NAL, CIP, NOR, ENR; AMP, AMC, CFZ, CTX, TET, NAL; AMP, AMC, CZ, TET, NAL; AMP, AMC, CFZ, CTX, CHL,TET, NAL, CIP, NOR, ENR, STX.			

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**-

lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**-miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**-ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**-spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**-piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.12: North, Central & South America- MDR phenotypes observed in *E. coli* isolates from chicken meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
20	17	ESBL-producers (80% of which were CMY-type Beta-Lactamase-producing *E coli*)	United States	2006-2007	[109]

ESBL- Extended-Spectrum Beta-Lactamase.

Table 3.13: North, Central & South America- MDR phenotypes observed in *E. coli* isolates from turkey meat

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
20	14	ESBL-producers (all of which were CMY-type Beta Lactamase producing *E coli*)	United States	2006-2007	[109]

ESBL- Extended-Spectrum Beta-Lactamase.

Table 3.14: Africa- MDR phenotypes observed in *E. coli* in chicken meat at retail level

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
73	38	N/S	Ghana (imported, country unknown)	N/S	[209]
36	24	N/S	Ghana (domestic production)	N/S	[209]

Table 3.15: Asia- MDR phenotypes observed in *E. coli* in chicken meat at retail level

Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
25	7	NON-ESBL PRODUCERS (N= 5): AMP, AMX, COTRIM, TET (n =2); AMP, AMX, COTRIM STR, TET(n =1); AMX, AMP, CIP, COTRIM, GEN, OFX, STR, TET (n =1); AMX, AMP, CHL, CIP, COTRIM, GEN, OFX, STR, TET (n =1) ESBL PRODUCERS (N= 2): AMX, AMP, AMC, AZT, CTX, CAZ, COTRIM, CHL, CIP, COTRIM, OFX, TET (n =1); AMX, AMP, AMC, AZT, CTX, CAZ, CRO, CHL, CIP, COTRIM, GEN, OFX, STR, TET (n =1)	India	N/S	[226]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Enterococcus faecalis

Table 3.16: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from milk and dairy products

Note: No data were available for the UK in eligible studies.

Food item	Number of food items	Number of isolates	PENICILLINS					3RD GEN CEPHALOSPORINS	CARBAPENEMS	(FLUORO)QUINOLONES		MACROLIDES	Country	Year	References
			% AMC	% AMP	% AMX	% OXA	% PEN	% CRO	% IPM	% CIP	% NAL	% ERY			
Cheese	4	27	--	--	--	100	0	--	--	--	--	0	Italy	2002	[227]
Cheese (fresh soft cheese)	110	9^1	0	0	--	--	0	--	--	0	--	1	Italy	2012	[72]
Cheese (Mozzarella)	168	2^1	0	0	--	--	0	--	--	0	--	0	Italy	2012	[72]
Milk (sheep, raw)	12	10	--	0	0	0	0	--	--	--	--	70	Italy	2001	[228]
Cheese (sheep)	34	2^1	--	0	--	--	--	--	--	0	--	0	Portugal	N/S	[229]
Cheese (sheep)	18	23	--	4.4	--	--	--	--	--	--	--	0	Slovakia	N/S	[230]
Milk (sheep, raw)	61	42	--	21.4	--	--	--	--	--	--	--	0	Slovakia	N/S	[230]
Cheese	30	62	--	30.6	--	88.7	--	79	22.5	33.8	--	90.3	Turkey	2000	[231]
Milk (raw)	78	96	--	36.5	--	99	--	62.5	59.4	43.8	--	91.7	Turkey	2000	[232]
Cheese (dairy)	N/S	15	--	20	--	--	--	--	--	0	100	0.67	Turkey	N/S	[233]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **ERY**- erythromycin; **IPM**- imipenem; **NAL-** nalidixic acid; **OXA**- oxacillin; **PEN**- penicillin (generic)

*1 For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.17: North, Central & South America - Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from milk and dairy products

Note- resistance to fluoroquinolones was not explored in eligible studies.

Food item	Number of food items	Number of isolates	PENICILLINS	MACROLIDES	Country	Year	References
			% AMP	% ERY			
Cheese (cow, processing)	3	12	0	8.3	Brazil	2015	[234]
Cheese (cow, processing)	9	1[*1]	0	0	Brazil	2015	[234]
Cheese (cow, retail)	15	22	0	4.5	Brazil	2015	[234]

AMP- ampicillin; **ERY**- erythromycin.
[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.18: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from milk and dairy products

Food item	Number of food items	Number of isolates	PENICILLINS		(FLUORO)QUINOLONES	MACROLIDES		Country	Year	References
			% AMC	% AMP	% CIP	% CLR	% ERY			
Cheese	100	13	0	0	15.38	0	7.69	Egypt	2013	(9)

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CIP**- ciprofloxacin; **CLR**- clarithromycin; **ERY**- erythromycin

Table 3.19: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from milk and dairy products

Note: No data were available in eligible studies

MDR phenotypes in *Enterococcus faecalis*

Table 3.20: UK & Europe- MDR phenotypes observed in *E. faecalis* isolates from milk and dairy products

Note: No data were available for the UK in eligible studies

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Cheese (various species)	N/S	48	ERY, KAN, TET (N= 2); ERY, KAN, MIN, TET (N= 6); CHL, ERY, KAN, MIN, TET (N= 25); CHL, ERY, KAN, MIN, SXT, TET (N= 4); CHL, ERY, GEN, MIN , KAN, SXT, TET (N= 2); ERY, GEN, KAN, MIN, SXT, TET (N= 1); CHL, ERY, KAN (N= 3); CHL, KAN, TET, MIN (N= 1); CHL, ERY, MIN, TET (N= 2); CHL, ERY, KAN, TET (N= 2)	France	2005	[235]
Cheese (dairy)	27	5	OXA, STR, TET (n= 5);	Italy	N/S	[227]
Raw milk (sheep)	42	3	AMP, GEN, PEN, (n= 3);	Slovakia	N/S	[230]
Milk (goat)	N/S	2	CIP, FUR, LVX, TET, RIF (n = 1); CIP, FUR, RIF, STH, TET (n =1)	Spain	N/S	[236]
Butter	N/S	3	CIP, Q-D, RIF, TET (n = 2); CIP, LVX, RIF, TET (n = 1)	Spain	N/S	[236]
Cheese (dairy)	N/S	12	CIP, Q-D, RIF (n = 2); CIP, RFA, TET (n = 1); CIP, ERY, LVX, Q-D, RIF, TEC, VAN (n = 1); CIP, CHL, ERY, RIF, TET (n = 1); ERY, RIF, TET (n = 1); CIP, FUR, RIF, Q-D, TET (n = 1); CHL, ERY, RIF, STH, TET, QD (n = 2) CIP, FUR, LVX, Q-D, RIF, STH, TET (n = 3)	Spain	N/S	[236]
Milk	N/S	1	CIP, FUR, LVX, TET, RIF, Q-D (n = 1)	Spain	N/S	[236]
Cheese (dairy)	253	113	CHL, ERY, TET (n = 74); CHL, ERY, RIF, TET (n = 20); ERY, NIT, TET (n = 19).	Switzerland	N/S	[237][1]
Cheese (dairy)	N/S	15	Most common MDR profiles: AMP, RIF, NAL, ERY; RIF, STR, NAL, ERY, VAN; RIF, CHL, NAL, ERY, VAN; TET, RIF, STR, NAL; TET, RIF, KAN, STR, NAL, ERY, VAN; AMP, TET, RIF, NAL, ERY, VAN	Turkey	N/S	[233]

[1]In this study, authors did selective reporting of AMR phenotypes for Enterococci with resistance to Chl, Ery or Tet therefore, other phenotypes may have not been reported.

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**-

gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.21: North, Central & South America - MDR phenotypes observed in *E. faecalis* isolates from milk and dairy products

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Milk (pasteurized)	6	3	CHL, ERY, STR (n= 1); ERY, TET, STR (n= 1); CHL, ERY, TET, STR (n= 1)	Brazil	2002-2004	[180]
Cheese (cow)	15	1	ERY, STR, TET	Brazil	2015	[234]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.22: Africa- MDR phenotypes observed in *E. faecalis* isolates from milk and dairy products

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References

Cheese (dairy)	13	7	CLI, KAN, STR, TET, VAN (n= 1); CLI, KAN, STR, TET (n= 1); CLI, GEN, KAN, LZD, STR, TET, VAN (n= 1); CLI, GEN, KAN, STR, VAN (n= 1); CIP, CLI, GEN, KAN, LZD, STR, TET, VAN (n= 1); CLI, GEN, KAN, STR, VAN, CIP, LZD, TET, CHL, ERY (n= 1); CIP, KAN, LZD, STR (n= 1)	Egypt	2013	[238]
Milk (raw and pasteurized)	415	56	AMP, TEC, VAN (N= 13); AMP, TET, VAN (N= 6); AMP, CEF, VAN (N= 10); TEC, TET, VAN (N= 3); CEF, TEC, VAN (N= 2); AMP, TEC, TET, VAN (N= 1); AMP, CEF, TEC, VAN (N= 14); AMP, CEF, TEC, TET (N= 5); AMP, CEF, TEC, TET, VAN (N= 5)	Botswana	1999	[183]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.23: Asia- MDR phenotypes observed in *E. faecalis* isolates from milk and dairy products

Note: No data were available in eligible studies

Enterococcus faecium

Table 3.24: UK & Europe - Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from milk and dairy products

Note: No data were available for the UK in eligible studies

Food item	Number of food items	Number of isolates	PENICILLINS				3RD GEN CEPHALOSPORINS		CARBAPENEMS	(FLUORO)QUINOLONES	MACROLIDES	Country	Year	References
			% AMC	% AMP	% OXA	% PEN	% CRO	% CTX	% IPM	% CIP	% ERY			
Cheese (goat)	N/S (Strain Culture)	N/S (Strain Culture)	0	0	--	0	0	--	0	--	--	Bulgaria	2006	[239]
Cheese (goat)	N/S (Strain Culture)	N/S (Strain Culture)	0	0	--	0	0	--	0	--	--	Bulgaria	2006	[239]
Cheese (goat)	N/S (Strain Culture)	N/S (Strain Culture)	0	0	--	0	0	--	0	--	--	Bulgaria	2006	[239]
Cheese (goat)	N/S (Strain Culture)	N/S (Strain Culture)	0	0	--	0	0	100	0	--	--	Bulgaria	2006	[239]
Cheese	4	102	--	--	100	0	0	--	--	--	0	Italy	2002	[227]
Cheese	110	24	0	4.2	--	12.5	--	--	--	20.8	37.5	Italy	2012	[72]
Cheese	168	23	0	0	0	0	--	--	--	4.4	16.7	Italy	2012	[72]
Cheese (sheep)	34	27	--	--	--	--	--	--	--	14.8	--	Portugal	N/S	[229]
Cheese (sheep)	18	23	--	26.1	--	--	--	--	--	--	13	Slovakia	N/S	[230]
Raw Milk (sheep)	61	18	--	5.6	--	--	--	--	--	--	5.6	Slovakia	N/S	[230]
Raw milk	78	51	--	471	98	--	72.5	--	74.5	64.7	92.3	Turkey	2000	[232]
Cheese	30	25	--	32	88	--	80	--	32	40	96	Turkey	2000	[231]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **CTX**- cefotaxime; **ERY**- erythromycin; **IPM**- imipenem; **OXA**- oxacillin; **PEN**- penicillin (generic)

Table 3.25: North, Central & South America - Antimicrobial resistance observed to beta-lactams, fluoroquinolones and macrolides in *E. faecium* isolates from milk and dairy products

Note: resistance to (fluoro)quinolones was not explored in eligible studies.

Food item	Number of food items	Number of isolates	PENICILLINS	MACROLIDES	Country	Year	References
			% AMP	% ERY			
Cheese (cow, retail)	15	41	0	0	Brazil	N/S	[234]
Cheese (cow, processing)	15	2^1	0	0	Brazil	N/S	[234]
Raw milk	105	9 ^1	--	--	Costa Rica	N/S	[240]
Cheese	18	5^1	5	2	Mexico	N/S	[241]

AMP- ampicillin; **ERY**- erythromycin

*1 For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.26: Africa - Antimicrobial resistance observed to beta-lactams, fluoroquinolones and macrolides in *E. faecium* isolates from milk and dairy products

Food item	Number of food items	Number of isolates	PENICILLINS		(FLUORO)QUINOLONES	MACROLIDES		Country	Year	References
			% AMC	% AMP	% CIP	% CLR	% ERY			
Cheese	100	37	0	0	5.4	0	5.4	Egypt	2013	[238]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CLR**- clarythromycin; **CIP**- ciprofloxacin; **ERY**- erythromycin

Table 3.27: Asia - Antimicrobial resistance observed to beta-lactams, fluoroquinolones and macrolides in *E. faecium* isolates from milk and dairy products

Note: resistance to (fluoro)quinolones, macrolides and polymyxins was not explored in eligible studies.

Food item	Number of food items	Number of isolates	PENICILLINS		Country	Year	References
			% AMP	% PEN			
Yogurt	N/S (Strain Culture)	Strain Culture	100	0	Mongolia	N/S	[242]

AMP- ampicillin; **PEN**- penicillin (generic)

MDR phenotypes in *Enterococcus faecium*

Table 3.28: UK & Europe- MDR phenotypes observed in *E. faecium* isolates from milk and dairy products

Note: No data were available for the UK in eligible studies

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Cheese (goat)	1 (culture)	2	VAN (VRE)	Bulgaria	N/S	[239]
Cheese (dairy)	24	2	CHL, CIP, ERY, GEN, PEN, TEC, VAN (n= 2)	Italy	2012	[72]
Butter	N/S	7	CIP, ERY, FUR, LVX, Q-D, RIF (n= 1); CIP, FUR, RIF (n= 1); CIP, FUR, RIF (n = 1); CIP, ERY, FUR, LVX, RIF (n= 2); FUR, TEC, VAN (n = 1); CIP, FUR, RIF (n= 1)	Spain	N/S	[236]
Milk (fermented)	N/S	4	CIP, ERY, LVX (n= 3); CIP, LVX, ERY, Q-D, RIF (n= 1)	Spain	N/S	[236]
Milk (goat)	N/S	4	CIP, FUR, LVX, RIF, TET (n= 2); CIP, FUR, RFA, STH, TET (n= 2)	Spain	N/S	[236]
Dairy cheese	N/S	3	CIP, ERY, FUR, LVX (n= 3)	Spain	N/S	[236]
Milk	N/S	1	CIP, FUR, LVX, Q-D, RFA, TET, (n= 1)	Spain	N/S	[236]
Cheese (dairy)	20	15	CIP, NIT, RIF, TET (n= 8); NIT, RIF, TET (n = 3); ERY, NIT, TET (n = 2); ERY, PEN, TET (n = 1); CIP, ERY, IMI, PEN, TET (n = 1)	Switzerland	N/S	[237][1]
Cheese (dairy)	35	35	list of MDR profiles: RIF, STR, NAL, ERY; AMP, STR, NAL, ERY; RIF, STR, NAL, ERY; RIF, NAL, ERY, VAN; RIF, NAL, ERY; RIF, STR, NAL, ERY, VAN; RIF, STR, NAL, ERY; RIF, KAN, STR, NAL, ERY; RIF, KAN, NAL, VAN; RIF, STR, NAL, ERY; STR, NAL, ERY, VAN; KAN, NAL, VAN; RIF, STR, NAL, ERY, VAN; STR, NAL, ERY; RIF, STR, NAL, ERY; AMP, RIF, STR, NAL ERY; RIF, KAN, STR, NAL; RIF, STR, NAL, ERY;	Turkey	N/S	[233]

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
			AMP, RIF, STR, NAL, VAN; RIF, KAN, STR, NAL; RIF, STR, NAL, VAN; RIF, STR, NAL; RIF, GEN, KAN, STR, NAL; RIF, NAL, ERY; RIF, STR, NAL, ERY; RIF, KAN, STR, NAL, ERY, VAN; AMP, RIF, KAN, STR, NAL, ERY, VAN; RIF, GEN, KAN, STR, NAL; AMP, TET, RIF, GEN, KAN, STR, CHL, NAL, VAN; RIF, KAN, STR, NAL, ERY, VAN; TET, CHL, NAL, ERY,VAN; TET, RIF, KAN, STR, NAL,ERY, VAN; AMP, TET, RIF, KAN, STR, NAL, ERY, VAN; TET, RIF, STR, CHL, NAL, ERY, VAN; TET, RIF, STR, NAL, ERY, VAN			

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.29: North, Central & South America- MDR phenotypes observed in *E. faecium* isolates from milk and dairy products

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Cheese (cow)	5	3	AMP, CHL, KAN, ERY, TET, VAN (n= 1); AMP, CHL, KAN, TET (n= 1); AMP, CHL, ERY, KAN, TET (n= 1)	N/S	Mexico	[241]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.30: Africa- MDR phenotypes observed in *E. faecium* isolates from milk and dairy products

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Milk (raw and pasteurized)	274	71	AMP, CEF, VAN, (n= 3); CEF, TEC, VAN (n= 3); AMP, TEC, TET (n= 6); AMP, CEF, TET, VAN (n= 6); AMP, TET, VAN (n= 6); AMP, CEF, TEC, VAN (n= 8); AMP, TEC, VAN (n= 18); AMP, CEF, TEC, TET, VAN (n= 21)	Botswana	1999	[183]
Cheese (dairy)	37	6	CIP, CLI, KAN, STR, TET, (n= 1); CIP, CLI, KAN, STR, VAN (n= 1); CLI, ERY, STR (n= 1); CLI, GEN, KAN, STR (n= 1); CHL, CLI, ERY (n= 1); CLI, STR, TET (n= 1)	Egypt	2013	[238]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.31: Asia- MDR phenotypes observed in *E. faecium* isolates from milk and dairy products

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Cheese	N/S	8	AMP, CIP, ERY, VAN	2010	Iran	[243]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Escherichia coli

Table 3.32: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *E. coli* isolates from milk and dairy products

Note: No data were available for the UK in eligible studies. Resistance to macrolides and polymyxins was not explored in eligible studies.

Food item	Number of food samples	Number of isolates	PENICILLINS			3RD GEN CEPHALOSPORINS			(FLUORO)QUINOLONES		Country	Year	References
			% AMC	% AMP	% AMX	% TIC	% CEF	% CTX	% CIP	% NAL			
Milk (dairy, raw)	263	270	0.4	30.4	--	--	--	0.7	0.7	1.5	Czech Republic	2010-2013	[244]
Cheese (raw milk cheese)	57	105	--	--	39	--	19	--	5	--	Spain	2007	[245]
Cheese (pasteurized, milk, non-organic cheese)	67	88	--	--	34.1	--	23.9	--	1	--	Spain	2007	[245]
Cheese (pasteurized, milk, organic cheese)	60	94	--	--	20.2	--	21.3	--	1	--	Spain	2007	[245]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CTX**- cefotaxime; **IPM**- imipenem; **NAL**- nalidixic acid; **PIP**- piperacillin; **TIC**- ticarcillin

Table 3.33: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *E. coli* isolates from milk and dairy products

Note: resistance to macrolides and polymyxins was not explored in eligible studies.

Food item	Number of food samples	Number of isolates	PENICILLINS			1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS					CARBAPENEMS	(FLUORO)QUINOLONES			Country	Year	References
			% AMC	% AMP	% TIC	% CEF	% FOX	% CAZ	% CRO	% CTX	% FET	% TIO	%IPM	% CIP	% ENR	% NAL			
Milk (dairy, pasteurised)	260	47	4.3	19	--	23	0	0	--	0	0	--	0	2.1	--	--	Brazil	2006-2007	(261)
Milk (dairy, pasteurised)	260	95	0	21	--	56	5.3	0	--	0	0	--	0	0	--	--	Brazil	2008	[246]
Cheese (Minas Frescal cheese)	30	90	--	--	--	36	--	--	11	--	--	--	--	0	--	0	Brazil	2007	[247]
Cheese (Minas Frescal cheese inspected by Government agencies)	50	150	--	--	--	16	--	--	0	--	--	--	--	0	--	13	Brazil	2007	[247]
Cheese (Minas Frescal cheese with spices)	31	90	--	--	--	8.9	--	--	2.2	--	--	--	--	1.1	--	16	Brazil	2007	[247]
Milk (dairy, raw)	25	19	--	11	--	--	--	--	--	--	--	--	5.3	--	--	0	Brazil	2010	[248]
Milk (dairy, raw)	54	10	--	8	6	--	--	--	--	--	--	3	--	--	0	--	United States	N/S	[249]
Milk (dairy, raw)	2,000	1,577	--	--	--	--	--	--	--	--	--	--	--	--	--	0	United States	2000	[250]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CAZ**- ceftazidime; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CRO**- ceftriaxone; **CTX**- cefotaxime; **ENR**- enrofloxacin; **FET**- cefetamet; **FOX**- cefoxitin; **IPM**- imipenem; **NAL**- nalidixic acid; **TIC**- ticarcillin; **TIO**- cefiofur

Table 3.34: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *E. coli* isolates from milk and dairy products

Note: No data were available in eligible studies

Table 3.35: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins in *E. coli* isolates from milk and dairy products

Food item	Number of food samples	Number of isolates	PENICILLINS			3RD GEN CEPHALOSPORINS			CARBAPENEMS		(FLUORO)QUINOLONES	Counrty	Year	References
			% AMC	% AMP	% AMX	% CTX	% CRO	% CAZ	% IPM	% MEM	% CIP			
Milk (dairy raw)	30	20	5	10	10	5	0	0	0	0	5	India	N/S	[226]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **CAZ**- ceftazidime; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **CTX**- cefotaxime; **IPM**- imipenem; **MEM**- meropenem

MDR phenotypes in *Escherichia coli*

Table 3.36: UK & Europe- MDR phenotypes observed in *E. coli* isolates from milk and dairy products

Note: No data were available for the UK in eligible studies

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Milk (dairy raw)	270	15	AMP, STR, TET (n= 5); AMP, KAN, STR, TET (n= 1); AMP, SXT, TET, TMP (n= 1); AMP, CHL, STR, TET (n= 2); AMP, CIP, CTX, NAL, SXT, TET, TMP (n= 2); AMP, KAN, NAL, STR, SXT, TET, TMP (n= 1); AMC, AMP, KAN, STR, SXT, TET, TMP (n= 1); AMP, GEN, KAN, STR, SXT, TET, TMP (n= 1); AMP, CHL, KAN, NAL, STR, SXT, TET, TMP (n= 1)	Czech Republic	2010-2013	[244]
Cheese (raw and pasteurised, from cow, ewe & goat)	N/S	2	AMC, AMX, AMP, ATM, CAZ, TIC, RIF, IPM, TZP, CHL, CEF, CST, MEZ, SXT; CAZ, ATM, CEF, CST, MEZ.	France	N/S	[251]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.37: North, Central & South America- MDR phenotypes observed in *E. coli* isolates from milk and dairy products

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Milk (dairy pasteurised)	47	0	ESBL-producers	Brazil	2006-2007	[252]
Cheese (Minas Frescal cheese with spices)	90	N/S	Most common phenotype: CEF, STR, TET (n= NS); STR, SXT, TET (n= NS); STR, SXT, TET (n= NS) CEF, STR, TET (n= NS)	Brazil	2007	[247]
Cheese (Minas Frescal inspected by Government agencies)	150	N/S	Most common phenotype: CEF, STR, TET (n= NS); STR, SXT, TET (n= NS)	Brazil	2007	[247]
Milk (dairy pasteurised)	95	6	AMP, CEF, FOX (n= 3); AMP, CEF, CHL (n= 3)	Brazil	2008	[246]
Milk (dairy raw)	10	3	AMP, CHL, GEN, TET, TIC, TIM, TIO (n= 1); AMP, CHL, FFC, TIO (n= 2)	United States	N/S	[249]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.38: Africa - MDR phenotypes observed in *E. coli* isolates from milk and dairy products

Note: No data were available in eligible studies

Table 3.39: Asia- MDR phenotypes observed in *E. coli* isolates from milk and dairy products

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Milk (dairy raw)	13	3	NON-ESBL PRODUCERS: AMX, AMP, COTRIM, TET (n=1); AMX, AMP, COTRIM, TET, STR (n=1); ESBL PRODUCERS: AMX, AMC, AMP, CTX, CHL, CIP, OFX, STR, TET (n=1)	India	N/S	[226]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime
ESBL- Extended-spectrum beta-lactamases

Enterococcus faecalis

Table 3.40: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from seafood

Note: No data were available in eligible studies

Table 3.41: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from seafood

Note: No data were available in eligible studies

Table 3.42: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from seafood

Note: No data were available in eligible studies

Table 3.43: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from seafood

Note: No data were available in eligible studies

MDR phenotypes in *Enterococcus faecalis*

Table 3.44: UK & Europe - MDR phenotypes observed in *E. faecalis* isolates from seafood

Note: No data were available for the UK in eligible studies

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Shrimp	5	5	Most common phenotypes: TET, TGC, FOF, CHL, NOR, CIP TE, TGC, FOF, TEC	Poland (imported from Vietnam, Thailand and Bangladesh)	N/S	[253]
Fish (wild)	6	3	ERY, Q-D, TET (n= 3)	Portugal	2007	[254]
Echinoderms (wild)	8	6	AMP, ERY, Q-D (n= 2); AMP, Q-D, TET (n= 1); GEN, KAN, Q-D (n= 1); AMP, ERY, Q-D, TET (n= 1)	Portugal	2011	[255]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.45: North, Central & South America- MDR phenotypes observed in *E. faecalis* isolates from seafood

Note: No data were available in eligible studies

Table 3.46: Africa- MDR phenotypes observed in *E. faecalis* isolates from seafood at capture and retail level

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Fish (farmed)	1	6	OXO, AMC, CRO, FOX, NEO, OXA SXT, TET, TOB (n= 1); OXO, OXA, OLE, RIF, TOB (n= 1); OXO, FOX, OXA, CRO, NEO, TOB (n= 1); OXO, CRO, FOX, OXA CHL, STR, TET (n= 1); OXO, FOX, NEO, OLE, OXA, STR, SXT, TOB (n= 1); OXO, CRO, FOX, NEO, OLE, OXA, STR, SXT, TOB (n= 1);	Tunisia	2007	[256]
Fish (farmed)	2	4	OXO, AMC, CRO, FOX, NEO, OLE, OXA, STR, TOB (n= 2); OXO, CRO, FOX, NEO, OLE, OXA, STR, TOB (n= 2);	Tunisia	2007	[256]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.47: Asia- MDR phenotypes observed in *E. faecalis* isolates from seafood

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Sashimi	31	13	CLI, GEN, STR (n= 1); CLI, ERY, KAN, STR, TET (n= 1); CLI, ERY, GEN, KAN, STR (n= 2); CLI, ERY, GEN, KAN, STR, TET (n= 3); CLI, GEN, KAN, STR, TET (n= 6)	Japan	2010	[257]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Enterococcus faecium

Table 3.48: UK & Europe - Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from seafood

Note: No data were available in the UK in eligible studies

Food item	Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES	MACROLIDES	Country	Year	References
			% AMP	% CIP	% ERY			
Gilthead seabream (wild)	118	67	4.5	4.5	59.7	Portugal	2007	[254]
Echinoderms (wild)	200	120	29.2	30.8	33.3	Portugal	2011	[255]
Anchovies (wild)	5	2^1	0	0	0	Spain	N/S	[258]
Mackerel (wild)	5	1^1	0	0	1	Spain	N/S	[258]
Codfish (wild)	5	4^1	0	0	0	Spain	N/S	[258]
Dogfish (wild)	5	1^1	0	0	0	Spain	N/S	[258]
Kingklip (wild)	5	1^1	0	0	1	Spain	N/S	[258]
Tuna (wild)	5	1^1	0	0	0	Spain	N/S	[258]
Shark (wild)	5	2^1	0	0	2	Spain	N/S	[258]
Swordfish (wild)	5	5^1	0	1	2	Spain	N/S	[258]
Venus clams	20-40	3^1	0	0	2	Spain	N/S	[258]
Clams	20-40	4^1	0	0	0	Spain	N/S	[258]

AMP- ampicillin; **CIP**- ciprofloxacin; **ERY**- erythromycin

*1 For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.49: North, Central & South American - Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from seafood

Note: No data were available in eligible studies

Table 3.50: Africa - Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from seafood

Note: No data were available in eligible studies

Table 3.51: Asia - Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from seafood

Note: No data were available in eligible studies

MDR phenotypes in *Enterococcus faecium*

Table 3.52: UK & Europe - MDR phenotypes observed in *E. faecium* isolates from seafood

Note: No data were available for the UK in eligible studies

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Rainbow trout (aquaculture)	4	4	AMK, CTX, CFZ, GEN, LZD, OXA, STX (n= 1); AMK, CTX, CFZ, GEN, LVX, OXA, RIF, STR, STX (n= 1); AMK, CTX, CFZ, FOF, GEN, OXA, STX (n= 1); AMK, CTX, CFZ, FOF, GEN, OXA, STX (n= 1)	2011	Greece	[259]
Gibel carp (wild)	5	5	AMK, CTX, CFZ, ERY, GEN, LVX, LZD, OXA, PEN, RIF, STR, STX (n= 1); AMK, CTX, CFZ, ERY, GEN, LVX, LZD, OXA, RIF, STR, STX (n= 1); AMK, CTX, CFZ, ERY, GEN, LVX, LZD, OXA, STR, STX (n= 1); AMK, CTX, CFZ, ERY, GEN, LVX, OXA, PEN, STR, STX (n= 1); AMK, CTX, CFZ, FOF, GEN, OXA, RIF, STR, STX (n= 1)	2011	Greece	[259]
Raw shrimp	3	3	TET, TGC, ERY, FOF	Poland (imported from Vietnam, Thailand and Bangladesh)	N/S	[253]
Fish (wild)	1	4	VRE isolate: AMP, CIP, ERY, TEC, VAN (n= 1); VRE isolate: ERY, TEC, VAN (n= 1); VRE isolate:AMP, CIP, ERY, KAN, TEC, TET, VAN (n= 1); VRE isolate: AMP, CIP, ERY, GEN, KAN, TET, TEC, VAN (n= 1)	2007	Portugal	[260]
Fish (wild)	67	4	ERY, KAN, Q-D, TET (n= 1); AMP, ERY, TET (n= 1); CHL, ERY, Q-D (n= 1); ERY, GEN, KAN (n= 1)	2007	Portugal	[254]
Echinoderms (wild)	120	7	AMP, ERY, TET (n= 4); AMP, KAN, TET (n= 1); CHL, CIP, TET (n= 1); CIP, ERY, TET (n= 1)	2011	Portugal	[255]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-

sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.53: North, Central, & South America - MDR phenotypes observed in *E. faecium* isolates from seafood

Note: No data were available in eligible studies

Table 3.54: Africa- MDR phenotypes observed in *E. faecium* isolates from seafood

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Fish (farmed)	3	3	OXO, AMX, CRO, FOX, NEO, OLE, OXA, RIF, STR, TOB	Tunisia	2007	[256]
Fish (farmed)	6	6	OXO, AMX, CRO, FOX, NEO, OLE, OXA, STR, TOB	Tunisia	2007	[256]
Fish (farmed)	2	8	OXO, AMX, CHL, NEO, OLE, OXA, STR (n=2); OXO, CRO, FOX, NEO, OLE, OXA, TOB (n= 2); OXO, AMX, FOX, NEO, OXA, STR, TOB (n= 2); OXO, CRO, FOX, NEO, OLE, OXA, STR, TOB (n= 2);	Tunisia	2007	[256]
Fish (farmed)	1	12	CHL, FOX, NEO, OXA, OLE, TOB (N=1); OXO, FOX, OXA, STR (n= 1); CRO, FOX, NEO, OXA, OLE, TOB (n= 1); OXO, NEO, OXA, OLE, STR, TET, TOB (n= 1); OXO, CHL, CRO, FOX, OXA, TET, STR (n= 1); OXO, CRO, FOX, NEO, OXA, STR, TOB (n= 1); AMX, AMC, CRO, FOX, OLE, OXA, STR, TOB (n= 1); AMX, AMC, FOX, NEO, OLE, OXA, STR, TOB (n= 1); AMX, AMC, CRO, FOX, NEO, OLE, OXA, TOB (n= 1); AR, CRO, FOX, NEO, OLE, OXA, RIF, STR, TOB (n= 1); AMX, AMC, CRO, FOX, NEO, OLE, OXA, STR, TOB (n= 1); AMX, AMC, CRO, FOX, NEO, OLE, OXA, STR, TET, TOB (n= 1)	Tunisia	2007	[256]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.55: Asia- MDR phenotypes observed in *E. faecium* isolates from seafood

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Sashimi	7	2	CLI, ERY, GEN, KAN (n= 1);	Japan	2010	[257]

			CLI, ERY, KAN, STR (n= 1)			

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Escherichia coli

Table 3.56: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. coli* isolates from seafood

Note: No data were available for the UK in eligible studies. Resistance to macrolides and polymyxins was not explored in eligible studies.

Food item	Number of food samples	Number of isolates	PENICILLINS		2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS		CARBAPENEMS	(FLUORO)QUINOLONES		Country	Year	References
			% AMC	% AMP	% FOX	% CAZ	% CTX	% IPM	% CIP	% NAL			
Echinoderms	250	10	10	0	0	0	0	0	0	0	Portugal	2011	[255]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CAZ**- ceftazidime; **CIP**- ciprofloxacin; **CTX**- cefotaxime; **FOX**- cefoxitin; **IPM**- imipenem; **NAL**- nalidixic acid

Table 3.57: North, Central and South America- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. coli* isolates from seafood

Note: resistance to polymyxins was not explored in eligible studies.

Food item	Number of food samples	Number of isolates	PENICILLINS				1st GEN CEPHALOSPORINS		2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS			CARBAPENEMS	(FLUORO)QUINOLONES		MACROLIDES	Country	Year	References
			% AMP	% CAR	% OXA	% PEN	% CEF	% LEX	% FOX	% CAZ	% CRO	% CTX	% IPM	% CIP	% NAL	% ERY			
Red snapper (wild fish)	10	16	0	--	--	--	0	--	0	--	--	--	0	0	0	--	Brazil	N/S	[261]
Mussels	N/S	44	2	100	40	49	--	10	57	0	0	0	--	0	--	62	Brazil	N/S	[262]
Fish (fresh & frozen)	6	8[^1]	1	--	--	--	1	--	--	--	--	--	--	--	0	3	Brazil	2010	[263]

AMP- ampicillin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **CTX**- cefotaxime; **ERY**- erythromycin; **FOX**- cefoxitin; **IPM**- imipenem; **LEX**- cephalexin; **NAL**- nalidixic acid; **OXA**- oxacillin; **PEN**- penicillin (generic)

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.58: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. coli* isolates from seafood

Note: resistance to polymyxins was not explored in eligible studies.

Food items	Number of food samples	Number of isolates	PENICILLINS		2ND GEN CEPHALOSPORINS		3RD GEN CEPHALOSPORINS	(FLUORO)QUINOLONES	Country	Year	References
			% AMC	% AMP	% CXM	% FOX	% CAZ	% NAL			
Fish (dried)	60	60	4	12.22	6.1	--	--	0	Kenya	N/S	[264]
Fish	3	1[^1]	--	0	--	0	0	1	Tunisia	2004-2005	[265]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CAZ**- ceftazidime; **CXM**- cefuroxime; **FOX**- cefoxitin; **NAL**- nalidixic acid

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentages

Table 3.59: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. coli* isolates from seafood

Note: resistance to macrolides was not explored in eligible studies.

Food item	Number of food samples	Number of isolates	PENICILLINS	1st GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS	4TH GEN CEPHALOSPORINS	CARBAPENEMS	(FLUORO)QUINOLONES	POLYMYXINS	Country	Year	References

			% AMC	% AMP	% PIP	% CEF	% FOX	% CRO	% CTX	% FEP	% IPM	% CIP	% NAL	% CST			
Fish (wild)	48	80	38	--	--	30	--	10	--	--	--	35	24	--	India	N/S	[266]
Fish	N/S	34	5.9	26.5	20.6	55	5.9	--	0	0	0	8.8	17.6	--	South Korea	2004-2006	[267]
Shrimp (aquaculture)	N/S	37	--	2.7	--	--	--	--	--	--	--	--	5.4	--	Thailand	2007-2008	[268]
Fish	14	1[*1]	--	--	--	--	--	--	--	--	--	--	--	0	Thailand	2012	[113]
Shrimp	13	1[*1]	--	--	--	--	--	--	--	--	--	--	--	0	Thailand	2012	[113]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CAZ**- ceftazidime; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **CST**- colistin; **CTX**- cefotaxime; **FEP**- cefepime; **FOX**- cefoxitin; **IPM**- imipenem; **NAL**- nalidixic acid; **PIP**- piperacillin

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

MDR phenotypes in *Escherichia coli*

Table 3.60: UK & Europe- MDR phenotypes observed in *E. coli* isolates from seafood

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Fish	1	1	AMP, CHL, SXT, TET	Albania	2012-2013	[205]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.61: North, Central & South America - MDR phenotypes observed in *E. coli* isolates from seafood

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Shrimp	16	2	AMP, SXT, TET	Brazil	N/S	[261]
Shrimp (aquaculture)	4	4	AMP, CEF, HET, SXT, TET	Brazil	N/S	[269]
Mussels	44	1	AMK, CAR, CLI, ERY, FOX, NIT, SXT, RIF, TET, VAN	Brazil	N/S	[262]
Cockles	1	1	AMX, ERY, CFL, NAL	Brazil	2010	[263]
Fish	1	4	AMP, ERY, GEN, (n=1); AMX , CEF, CHL, ERY, GEN (n=1); AMX, ERY, CEF, CHL, TET (n=1); CHL, ERY, GEN, TET, (n=1)	Brazil	2010	[263]
Fish (aquaculture)	15	1	AMP, SXT, TET	Brazil	2012	[270]
Mussels	6	2	AMX, STR, SXT, TET (n=1); AMX, CHL, STR, SXT, TET (n=1)	Canada	2012	[271]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.62: Africa- MDR phenotypes observed in *E. coli* isolates from seafood

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Fish (dried)	60	5	AMP, GEN, SXT, TET (n= 1); AMP, SXT, TET, (n= 2); AMP, AMC, TET (n= 1); CXM, KAN, SXT (n= 1)	Kenya	N/S	[264]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.63: Asia- MDR phenotypes observed in *E. coli* isolates from seafood

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Fish (aquaculture)	112	19	ESBL-producers	China	2010	[272]
Fish	80	16	AMP, AMX, CEF, CIP, NAL, TET	India	N/S	[266]
Fish (dried fish)	6	2	CIP, NAL, STR, SXT, TET (n= 1); AMP, AMC, CHL, CIP, GEN, KAN, NAL, STR, SXT, TET, TIC (n= 1)	Korea, South	2010-2012	[273]
Nile Tilapia (aquaculture)	60	12	ESBL-producers	Philippines	2005	[274]
Shrimp (aquaculture)	27	5	AMP, CHL, TET (n= 1); AMP, KAN, TET (n= 2); AMP, NAL, TET (n= 1); CHL, KAN, STR, TET, TMP (n= 1)	Thailand	2007-2008	[268]
Shrimp (aquaculture)	37	1	AMP, NAL, TET	Thailand	2007-2008	[268]
Fish	1	1	CRO, FOX, GEN, NAL and/or CIP (not specified by authors)	Thailand	2012	[113]
Shellish	1	1	CRO, FOX,GEN, NAL and/or CIP (not specified by authors)	Thailand	2012	[113]
Fish	2	2	Phenotypes observed in sulfonamide-resistant *E coli* isolates: AMP, SUL, STR, SXT, TET (n= 1); AMP, NAL, SUL, STR, SXT, TET (n= 1).	Tunisia	2004-2005	[265]
Shellfish	20	5	AMC AMP, AMX, CEF, CHL, ENR, NAL, SUL, STR, TET, TMP(n= 1); AMC, AMP, AMX, CIP, CHL, ENR, NAL, NOR, STR, SUL TET, TMP (n= 1); AMC, AMP, AMX, CEF, CIP, ENR, KAN, NAL, NOR, STR, SUL, TET, TMP (n= 1); AMC, AMP, AMX, CEF, CHL, ENR, GEN, NAL, TET, STR, SUL, TMP (n= 1); AMC, AMP, AMX, CEF, CHL, STR, SUL, TET, TMP (n= 1)	Vietnam	2004	[105]
Shellfish	2	2	AMC, AMP, AMX, CEF, GEN, NAL, STR, SUL, TET, TMP (n=1); AMP, AMX, CHL, NAL, STR, SUL, TMP, TET, (n=1).	Vietnam	2004	[56]
Shrimp	60	11	ESBL-producers	Vietnam	2013	[106]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime
. **ESBL**- Extended-Spectrum Beta-Lactamase producing bacteria

Enterococcus faecalis

Table 3.64: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from vegetables and fruit

Note: No data were available for the UK in eligible studies

Food item	Number of food samples	Number of isolates	PENICILLINS			CARBAPENEMS	(FLUORO)QUINOLONES		MACROLIDES		Country	Year	References
			% AMC	% AMX	% PEN	% IPM	% CIP	% ENR	% ERY	% TYL			
Fruit, vegetables, roots, bulbous vegetables, & cereals	702	58	0	--	--	3.4	0	0	24.2	17.2	Germany	2004-2005	[275]
Fruit, vegetables, roots, bulbous vegetables, & cereals	299	42	0	--	--	4.8	4.8	0	21.5	4.8	Germany	2004-2005	[275]
Salads	214	1[*1]	0	--	0	--	0	--	0	--	Italy	2012	[176]
Ready-to-eat salads	50	18	--	0	--	--	0	--	6	--	Portugal	2010	[276]
Ready-to-eat salads	50	9[*1]	--	0	--	--	0	--	1	--	Portugal	2010	[276]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **CIP**- ciprofloxacin; **ENR**- enrofloxacin; **ERY**- erythromycin; **IPM**- imipenem; **PEN**- penicillin (generic); **TYL**- tylosin

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.65: North, Central and South America - Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from vegetables and fruit

Food item	Number of food samples	Number of isolates	PENICILLINS	(FLUORO)QUINOLONES	MACROLIDES		Country	Year	References
			% PEN	% CIP	% ERY	% TYL			
Fruit	18	3^1	0	0	0	0	United States	2000-2001	[277]
Vegetables	98	20	0	1	0	0	United States	2000-2001	[277]
Apples	31	1^1	0	0	0	0	United States	2000-2001	[78]
Tomatoes	27	2^1	0	0	0	0	United States	2000-2001	[78]
Cucumber	20	4^1	0	1	0	0	United States	2000-2001	[78]
Lettuce	51	1^1	0	1	0	0	United States	2000-2001	[78]
Potatos	62	13	0	0	0	0	United States	2000-2001	[78]
Sprout	16	2^1	0	0	0	0	United States	2000-2001	[78]

CIP- ciprofloxacin; **ERY**- erythromycin; **PEN**- penicillin (generic); **TYL**- tylosin

*1 For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.66: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from vegetables and fruit

Note: No data were available in eligible studies

Table 3.67: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecalis* isolates from vegetables and fruit

Note: No data were available in eligible studies

MDR phenotypes in *Enterococcus faecalis*

Table 3.68: UK & Europe - MDR phenotypes observed in *E. faecalis* isolates fron vegetables and fruit

Note: No data were available for the UK in eligible studies

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Vegetables	42	1	CIP, DOX , ERY FOS, NAF, RIF, SXT	Germany	2004-2005	[275]
Olives	N/S	1	CMP, ERY, Q-D ,RIF, TET	Spain	N/S	[236]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.69: North, Central & South America- MDR phenotypes observed in *E. faecalis* isolates from vegetables and fruit

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Vegetables	20	N/S	CIP, BAC, KAN , , FL, LCM, NIT, Q-D, STR, TET	United States	2000-2001	[277]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.70: Africa- MDR phenotypes observed in *E. faecalis* isolates from vegetables and fruit

Note: No data were available in eligible studies

Table 3.71: Asia- MDR phenotypes observed in *E. faecalis* isolates from vegetables and fruit

Note: No data were available in eligible studies

Enterococcus faecium

Table 3.72: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from vegetables and fruit
Note: No data were available in eligible studies

Table 3.73: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from vegetables and fruit
Note: No data were available in eligible studies

Table 3.74: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from vegetables and fruit
Note: No data were available in eligible studies

Table 3.75: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones and macrolides observed in *E. faecium* isolates from vegetables and fruit
Note: No data were available in eligible studies

MDR phenotypes in *Enterococcus faecium*

Table 3.76: UK & Europe- MDR phenotypes observed in *E. faecium* isolates from vegetables and fruit

Note: No data were available for the UK in eligible studies.

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Vegetables	59	5	ERY, DOX, ENR, FOS, STR, RIF, TLC	Germany	2004-2005	[275]
Vegetables	1	1	CIP, ERY, GEN, TET, VAN , PEN	Italy	2012	[176]
Packed Mediterranean salad	1	1	AMP, ERY, TET , CAZ, CTX	Spain	N/S	[278]
Soybean sprout	2	1	ERY, TET, CIP , CAZ, CTX, RIF	Spain	N/S	[278]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.77: North, Central, & South America- MDR phenotypes observed in *E. faecium* isolates from vegetables and fruit

Note: No data were available in eligible studies

Table 3.78: Africa- MDR phenotypes observed in *E. faecium* isolates from vegetables and fruit

Note: No data were available in eligible studies

Table 3.79: Asia- MDR phenotypes observed in *E. faecium* isolates from vegetables and fruit

Note: No data were available in eligible studies

Escherichia coli

Table 3.80: UK & Europe- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from vegetables and fruit

Note: No data were available for the UK in eligible studies. Resistance to macrolides was not explored in eligible studies.

Food item	Number of food samples	Number of isolates	PENICILLINS			3RD GEN CEPHALOSPORINS		(FLUORO)QUINOLONES		POLYMYXINS	Country	Year	References
			% AMX	% AMC	% AMP	% CAZ	% CTX	% CIP	% NAL	% CST			
Spring onion (conventional farming)	1	1^1	--	0	1	--	--	--	0	--	Czech Republic (imported from Germany)	2011-2013	[279]
Mung sprouts (conventional farming)	2	2^1	--	0	1	--	--	--	0	--	Czech Republic (imported from China)	2011-2013	[279]
Mung sprouts (conventional farming)	3	3^1	--	0	0	--	--	--	0	--	Czech Republic	2011-2013	[279]
Chickpeas sprouts (conventional farming)	1	1^1	--	0	1	--	--	--	0	--	Czech Republic (imported from Canada)	2011-2013	[279]
Alfafa seed sprouts (conventional farming)	1	1^1	--	0	0	--	--	--	0	--	Czech Republic	2011-2013	[279]
Red beet sprouts (conventional farming)	1	1^1	--	0	1	--	--	--	0	--	Czech Republic (imported from the Netherlands)	2011-2013	[279]
Sprout mix (conventional farming)	1	1^1	--	0	1	--	--	--	0	--	Czech Republic (imported from the Netherlands)	2011-2013	[279]
Rucola (conventional farming)	3	3^1	--	0	1	--	--	--	0	--	Czech Republic (imported from the Netherlands)	2011-2013	[279]
Rucola (conventional farming)	1	1^1	--	0	0	--	--	--	0	--	Czech Republic (imported from Austria)	2011-2013	[279]
Spring onion (organic farming)	1	1^1	--	0	0	--	--	--	0	--	Czech Republic	2011-2013	[279]
Curly lettuce (conventional farming)	1	1^1	--	0	1	--	--	--	0	--	Czech Republic	2011-2013	[279]

Food item	Number of food samples	Number of isolates	PENICILLINS			3RD GEN CEPHALOSPORINS		(FLUORO)QUINOLONES		POLYMYXINS	Country	Year	References
			% AMX	% AMC	% AMP	% CAZ	% CTX	% CIP	% NAL	% CST			
Spinach (conventional farming)	2	2^1	--	0	1	--	--	--	0	--	Czech Republic (imported from Austria)	2011-2013	[279]
Leek (conventional farming)	1	1^1	--	0	0	--	--	--	0	--	Czech Republic (imported from Belgium)	2011-2013	[279]
Raddish (organic farming)	1	1^1	--	0	0	--	--	--	0	--	Czech Republic	2011-2013	[279]
Chinese cabbage (conventional farming)	1	1^1	--	0	0	--	--	--	0	--	Czech Republic (imported from Poland)	2011-2013	[279]
Asparagus (organic farming)	1	1^1	--	0	1	--	--	--	0	--	Czech Republic (imported from Slovakia)	2011-2013	[279]
Leafy lettuce (conventional farming)	1	1^1	--	0	1	--	--	--	1	--	Czech Republic	2011-2013	[279]
Leafy lettuce (conventional farming)	1	1^1	--	0	1	--	--	--	1	--	Czech Republic (imported from the Netherlands)	2011-2013	[279]
Cauliflower (conventional farming)	2	1^1	--	0	1	--	--	--	0	--	Czech Republic	2011-2013	[279]
Cucumber (conventional farming)	1	1^1	--	0	1	--	--	--	0	--	Czech Republic (imported from Macedonia)	2011-2013	[279]
Vegetables	80	80	--	--	3	--	--	--	0	--	Denmark	1999	[61]
Fresh herb (water morning glory)	N/S	1^1	--	--	1	--	--	--	0	--	The Netherlands (imported from Thailand)	2011	[280]
Fresh herb (Asian pennywort)	N/S	1^1	--	--	2	--	--	--	2	--	The Netherlands (imported from Vietnam)	2011	[280]
Fresh herb (Betel leaf)	N/S	2^1	--	--	2	--	--	--	1	--	The Netherlands (imported from Thailand)	2011	[280]
Fresh herb (Acacia leaf)	N/S	2^1	--	--	2	--	--	--	1	--	The Netherlands (imported from Thailand)	2011	[280]
Celery, bunched carrots,	1,216	1^1		--	--				1		The Netherlands	2012	[281]

Food item	Number of food samples	Number of isolates	PENICILLINS			3RD GEN CEPHALOSPORINS		(FLUORO)QUINOLONES		POLYMYXINS	Country	Year	References
			% AMX	% AMC	% AMP	% CAZ	% CTX	% CIP	% NAL	% CST			
butterhead lettuce, chicory, endive, iceberg lettuce, spring onion, radish (blanched)			--			--	--	--		--			
Vegetables	170	128	--	--	2.3	0	0	1.6	--	0	The Netherlands	2012	[7]
Vegetables	N/S	3^1	--	--	3	--	--	--	0	0	Poland	2006	[71]
Salads (ready-to-eat)	50	78	49	--	--	--	--	5	36	--	Portugal	2010	[276]

Note: Out of the 18 articles, five were not detailed in this table as investigated only for MDR [113, 236, 275, 282, 283].
AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CAZ-** ceftazidime; **CST-** colistin; **CTX-** cefuroxime; **NAL**- nalidixic acid;
*1 For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.81: North, Central & South America- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from vegetables and fruit

Note- resistance to macrolides and polymyxins was not explored in eligible studies.

Food item	Number of food samples	Number of isolates	PENICILLINS		1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS	3RD GEN CEPHALOSPORINS			(FLUORO)QUINOLONES		Country	Year	References
			% AMC	% AMP	% CEF	% FOX	% CAZ	% CRO	% TIO	% CIP	% NAL			
Vegetables	68	33	18	--	--	15	--	0	0	0	36	Canada	2012	[284]
Spinach, lettuce, chard	66	84	--	38	29	--	--	--	--	18	N/S	Mexico	2008	[37]

Note: Out of the 18 articles, five were not detailed in this table as investigated only for MDR [113, 236, 275, 282, 283].
AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CAZ**- ceftazidime; **CEF**- cephalothin; **CIP**- ciprofloxacin; **CRO**- ceftriaxone; **FOX**- cefoxitin; **NAL**- nalidixic acid; **TIO**- cefiofur

Table 3.82: Africa- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from vegetables and fruit

Note- resistance to macrolides and polymyxins was not explored in eligible studies.

Food item	Number of food samples	Number of isolates	PENICILLINS		3RD GEN CEPHALOSPORINS			4TH GEN CEPHALOSPORINS		(FLUORO)QUINOLONES		Country	Year	References
			%AMC	%AMP	%CAZ	%CRO	%CTX	% FEP	% QUI	% ENR	%NAL			

Onions	60	5[*1]	0	3	0	1	0	0	0	1	1	South Africa	2012	[285]

AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **CAZ-** ceftazidime; **CRO**- ceftriaxone; **CTX**- cefotaxime; **ENR-** enrofloxacin; **FEP-** cefepime; **NAL**- nalidixic acid; **QUI-** cefquinome

[*1] For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

Table 3.83: Asia- Antimicrobial resistance to beta-lactams, fluoroquinolones, macrolides and polymyxins observed in *E. coli* isolates from vegetables and fruit

Food item	Number of food samples	Number of isolates	PENICILLINS				1ST GEN CEPHALOSPORINS	2ND GEN CEPHALOSPORINS		3RD GEN CEPHALOSPORINS			CARBAPENEMS		(FLUORO)QUINOLONES		POLYMYXINS	Country	Year	References
			% AMC	% AMP	% AMX	% CAR	% CEF	% FOX	% CMX	% CAZ	% CRO	% CTX	% IPM	% MEM	% CIP	% NAL	% CST			
Vegetables	30	23	0	21.7	21.7	--	--	--	--	8.7	8.7	8.7	0	4.2	4.3	--	--	India	N/S	[226]
Salad (carrots, radishes, cabbage, tomatoes, cucumbers, lettuce, celery, coriander)	N/S	N/S	--	18.6	--	62.8	--	--	--	--	--	4.6	--	--	0	11.6	--	India	N/S	[286]
Vegetables (rocket leaves, leafy green vegetables and green onion)	N/S	2^*1	0	0	--	--	0	0	0	0	--	0	0	0	0	--	0	Saudi Arabia	2011	[287]
Sprout	327	7^*1	--	--	--	--	--	--	--	--	0	--	--	--	--	--	--	South Korea	2010-2011	[273]

Note: Out of the 18 articles, five were not detailed in this table as investigated only for MDR [113, 236, 275, 282, 283].
AMC- amoxicillin-clavulanic acid; **AMP**- ampicillin; **AMX**- amoxicillin; **CAR**- carbenicillin; **CEF-** cephalotin; **CIP**- ciprofloxacin; **CMX-** cefuroxime; **CRO**- ceftriaxone; **CST-** colistin; **CTX**- cefotaxime; **FOX-** cefoxitin; **IPM**- imipenem; **MEM**- meropenem; **NAL**- nalidixic acid
*1 For studies where the number of isolates tested for antimicrobial susceptibility was below 10, frequency of resistant isolates was reported for each antimicrobial rather than percentage.

MDR phenotypes in *Escherichia coli*

Table 3.84: UK & Europe- MDR phenotypes observed in *E. coli* isolates from vegetables and fruit

Note: No data were available for the UK in eligible studies

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Asparagus	1	1	AMP, STR, TET	Czech Republic	2011-2013	[279]
Rucola	1	1	AMP, NAL, SXT, TET, TMP	Czech Republic	2011-2013	[279]
Vegetables	N/S	N/S	AMP, COTRIM STR, MZL, SULF, TET AMP, COTRIM, GEN, NAL, MZL, STR, SULF, TET AMP, CIP, CMP, COTRIM, GEN, KAN, MZL, NAL, STR, SULF, TET	Germany	N/S	[282]
Vegetables	17	9	Retail: AMP, CEC, COL, COX, CXM, FLL, SPT (n=1); AMP, CEC, CET, CMP, COX CXM, SPT (n=1); AMC, AMP, CXM, CMP, CEC, CET, COX, FLL, SPT (n=1); AMC, AMP, CXM, CTX, CMP, MZL, CEC, COX, CET, FLL (n=1); AMC, AMP, CXM, COL, CMP, DOX, CEC, COX, SPT, FLL (n=1); Farm retail: AMC, AMP, APR, CEC, DOX, MZL, PIP (n= 1); AMP, CEC, DOX, MZL, PIP, STR, SXT (n= 1); AMP, APR, CEC, DOX, MZL, PIP, SPT, STR, SXT (n= 1); AMC, AMP, CEC, CET, CMP, COX, CTX, CXM, FLL, MZL, SPT (n= 1)	Germany	2004-2005	[275]
Fresh herb (Water morning glory)	1	1	AMP, CAZ, CIP, CTX, GEN, SXT, TET	The Netherlands	2011	[280]
Fresh herb (Asian pennywort)	1	1	AMP, CAZ, CIP, CMP, CTX, FFN, NAL, STR, SXT, TET	The Netherlands	2011	[280]
Fresh herb (Betel leaf)	2	2	AMP, CIP, CMP, CTX , FFN, GEN, SMX, STR; (n=1) AMP, CIP, CMP, CTX, GEN, FFN, NX, STR, SXT, TET (n=1)	The Netherlands	2011	[280]
Fresh herb (Acacia leaf)	2	2	AMP, CAZ, CIP, CMP, CTX, FFN, GEN, KAN, NAL, STR, SXT, TET, (n= 1); AMP, CAZ, CMP, CTX, FFN, GEN, KAN, STR, SXT, TET (n= 1)	The Netherlands	2011	[280]
Vegetables	5	2	AMP, NEO, STR	Poland	2006	[71]
Salads (ready-to-eat)	78	16	AMX, NAL, STR, SXT, TET ; CMP, NAL, STR, TET, TMP; CIP, NAL, SMX, TET; AMX, STR, SXT, TET; AMX, STR, TET; AMX, NAL, STR, SXT, TET;	Portugal	2010	[276]

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
			AMX, STR, SXT, TET; AMX, SXT, TET; AMX, NAL, STR, SXT, TET; STR, SXT, TET; AMX, STR, SXT; AMX, NAL, STR, SXT, TET; CIP, NX, TET; AMX, STR, TET; STR, SXT, TET; AMX, STR, SXT, TET			
Leafy greens	N/S	N/S	0% ESBLs-producers 0% AmpC-producers	Sweden (domestic)	2012-2013	[288]
Leafy greens	N/S	N/S	0% ESBLs-producers 0% AmpC-producers	Sweden (imported, country unknown)	2012-2013	[288]
Basil leaves	N/S	8	ESBL-producers: From these, one presented the MDR phenotype: AMP, AMC, CEF, CTX, CIP, CST, GEN, TET, STR, CHL, NAL, SMZ, TMP.	Switzerland (imported from Vietnam)	2014	[289] ^1
Cha-Om	N/S	11	ESBL-producers: From these, one presented the MDR phenotype: AMP, CEF, CST, CTX, CIP, GEN, TET, STR, KAN, NAL, SMZ	Switzerland (imported from Thailand)	2014	[289] ^1

^1 This study reported a total of 60 ESBL strains from 42 imported vegetables from the following countries (Dominican Republic, Thailand and Vietnam).

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q-D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

ESBL- Extended-spectrum beta-lactamases

Table 3.85: North, Central & South America- MDR phenotypes observed in *E. coli* isolates from vegetables and fruit

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Vegetables	33	7	AMK, GEN, KAN, NAL, SXT, TMP (n= 3); AMC, AMP, COX, NAL (n= 4)	Canada	2012	[284]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.86: Africa- MDR phenotypes observed in *E. coli* isolates from vegetables and fruit

Food item	Total number of isolates tested	Number of MDR isolates	MDR phenotypes	Country	Year	References
Onions	5	1	AMP, ENR, NAL, TET, STX	South Africa	2012	[285]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC-** teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

Table 3.87: Asia- MDR phenotypes observed in *E. coli* isolates from vegetables and fruit

Food item	Details	No. of isolate tested	No. of isolate with MDR	MDR phenotypes	Country of origin	Study year	References
Vegetables	N/S	23	4	AMP, AMX, CMP, GEN, STR (n= 1); AMP, AMX, CIP, GEN, STR, TET, COTRIM (n= 1); AMP, AMX, AMC, AZT, CTX, CAZ, GEN, PIP, STR, TET, CRO, OFX, COTRIM (n= 1); AMP, AMX, AMC, AZT, CTX, CAZ, CIP, MEM, TET, CRO , COTRIM, OFX (n= 1)	India	N/S	[226]
Vegetables	N/S	120	8	AMP, PIP, CTX, SXT, CEC , LEV (n= 2); AMP, PIP, CEC, SXT , LEV (n= 3); AMP, PIP, GEN, SXT (n= 3)	South Korea	2011	[290]
Vegetables	Sprout	7	1	CMP, STR, TET	South Korea	2010-2011	[273]

AMC- amoxicillin-clavulanic acid; **AMK**- amikacin; **AMP**- ampicillin; **AMX**- amoxicillin;; **ATM**- aztreonam; **AVI-** avoparcin; **AZL**- azlocillin; **AZM**- azithromycin; **BAC-** bacitracin; **CAM**- midecamycin; **CAR**- carbenicillin; **CAZ**- ceftazidime; **CCT**- cephacetrile; **CDN**- cefditoren; **CDR**- cefdinir; **CEC**- cefaclor; **CEF**- cephalothin; **CFD**- cephadrine; **CFM**- cefixime; **CFP**- cefoperazone; **CFR**- cefadroxil; **CFZ**- cephazolin; **CHL**- chloramphenicol; **CID**- cefonicid; **CIN**- cinoxacin; **CIP**- ciprofloxacin; **CLA**- clavulanic acid; **CLD**- cephaloridine; **CLI**- clindamycin; **CLR**- clarithromycin; **CLX**- clinafloxacin; **CMZ**- cefmetazole; **COTRIM**- cotrimoxazole **CPD**- cefpodoxime; **CPR**- cefprozil; **CRO**- ceftriaxone; **CST**- colistin; **CTB**- ceftibuten; **CTT**- cefotetan; **CTX**- cefotaxime; **CXM**- cefuroxime; **DAN**- danofloxacin; **DAP**- daptomycin; **DCX**- dicloxacillin; **DIF**- difloxacin; **DIP**- tildipirosin; **DIR**- dirithromycin; **DOX**- doxycycline; **DTM**- dirithromycin; **ENR**- enrofloxacin; **ENX**- enoxacin; **ETP-** Ertapenem; **ERY**- erythromycin; **FAM**- cefamandole; **FEP**- cefepime; **FET**- cefetamet; **FFC**- florfenicol; **FLE**- fleroxacin;**FLU**- fluorithromycin; **FLX**- flucoxacin; **FOF**- fosfomycin; **FOX**- cefoxitin; **GAM**- gamithromycin; **GAT**- gatifloxacin; **GEN**- gentamicin; **GRX**- grepafloxacin; **HAP**- cephapirin; **HET**- hetacillin; **IBA**- ibafloxacin; **IPM**- imipenem; **JOS**- josamycin; **KAN**- kanamycin; **LAT**- latamoxef; **LEX**- cephalexin; **LOM**- lomefloxacin; **LOR**- loracarbef; ; **LVX**- levofloxacin; **LZD**- linezolid; **MCL**- mecillin; **MAR**- marbofloxacin; **MEM**- meropenem; **MET**- methicillin; **MEZ**- mezlocillin; **MIC**- tilmicosin; **MIN**- minocycline; **MIO**- miokamycin; **MOX**- moxalactam; **MXF**- moxifloxacin; **NAF**- nafcillin; **NAL**- nalidixic acid; **NAR-** narasin; **NEO**- neomicin; **NET**- netilmicin; **NIT**- nitrofurantoin; **NOR**- norfloxacin; **OLE**- oleandomycin; **OFX**- ofloxacin; **ORB**- orbifloxacin; **OXO-** oxolinic acid; **OXA**- oxacillin; **PEN**- penicillin (generic); **PIP**- piperacillin; **PIV**- Pivampicillin; **PMB**- polymyxin B; **PRA**- pradofloxacin; **Q**-**D**- quinupristin-dalfopristin; **QUI**- cefquinome; **RAD**- cephradine; **RFB**- rifabutin; **RFP**- rifapentine; **RIF**- rifampin; **ROK**- rokitamycin; **ROX**- rosithromycin; **SAM**- ampicillin-sulbactam; **SMZ-** sulfamethoxazole; **SPR**- spiromycin; **SPT**- spectinomycin; **SPX**- sparfloxacin; **STR**- streptomycin; **SUL**- sulbactam; **SXT**- trimethoprim-sulfamethoxazole; **TEC**- teicoplanin; **TEL**- telithromycin; **TEM**- temocillin; **TET**- tetracycline; **TGC**- tigecycline; **TIC**- ticarcillin; **TIM**- ticarcillin-clavulanic acid; **TIO**- Cefiofur; **TOB**- tobramycin; **TMP**- trimethoprim; **TUL**- tulathromycin; **TVA**- trovafloxacin; **TVL**- tylvasolin; **TYL**- tylosin; **TZB**- tazobactam; **TZP**- piperacillin-tazobactam; **VAN**- vancomycin; **VIR-** virgiamycin; **ZOX**- ceftizoxime

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