

Campylobacter contamination in fresh whole UK-produced chilled chickens at retail: October – December 2015

This report presents the results of the UK Survey of Campylobacter contamination in fresh retail chicken and its packaging, for the period Oct-Dec 2015. These results are based on a total of 966 fresh, whole, chilled, unflavoured chickens sampled at retail. The overall results are weighted to reflect retailer market share¹.

The present survey began at the start of July 2015 and will be running for a full 12 months. A planned 4,000 chickens will be sampled at retail and tested for their level of Campylobacter contamination. The present survey may be referred to as Year 2 as it follows on from an equivalent survey (Year 1) which was intended to represent the 12 months starting mid-Feb 2014. The results of the first 3 months of the current survey (Jul-Sep 2015) were published in November 2015 and can be found at:

www.food.gov.uk/sites/default/files/campylobacter-retail-survey-jul-sept-2015.pdf

The figures in this report are estimates based on a sample survey and so there is a degree of uncertainty associated with them. All tables and charts include 95% confidence intervals which reflect the uncertainty in the results. They provide a range of values within which the true value will lie 95% of the time.

A methodological issue has arisen which raises questions over the validity of our reported summary measures of Campylobacter contamination in chickens at retail and it is likely to have a greater impact on any further results from the survey in its current form. This issue is discussed in more detail on pages 8-11. Our measure of Campylobacter contamination on outer packing of chickens at retail is not affected by this issue.

Key results

- The latest results show that in Oct-Dec 2015, 10.7% of chickens (skin samples) had high levels of Campylobacter (over 1000 cfu/g), a statistically significant reduction from 18.9% over the same period the previous year (Oct-Dec 2014). So the prevalence of highly contaminated chickens has been significantly lower than the same time the previous year for both quarters of the current survey (see Figure 1, page 4).
- For comparing the percentage of chickens with levels of Campylobacter above 1000 cfu/g between retailers, each retailer was compared to the overall average (weighted according to market share) among all other retailers:
 - The only named retailer which had a significantly lower prevalence compared to the average among all other retailers was Morrisons (5.4%).
 - The only named retailer which had a significantly higher prevalence compared to the average among all other retailers was Sainsbury's (17.6%).

¹ The weighting is based on market share data provided by Kantar for the 52 weeks ending 1st February 2015.

Background to the survey

Foodborne *Campylobacter* is estimated to make more than 280,000 people ill each year in the UK and is the biggest cause of food poisoning. An EFSA Opinion² stated that up to 80% of cases can be attributed to raw poultry meat and a tenfold decrease in the exposure levels from this source is likely to reduce the number of human *Campylobacter* cases by 50 to 90% across all Member States.

The Food Standards Agency (FSA) agreed a joint target with industry to reduce *Campylobacter* in chicken. The target is focussed on levels greater than 1000 colony forming units per gram (cfu/g). It is thought that chickens with this level of *Campylobacter* contamination are the most likely to infect consumers.

The joint FSA-industry target was to reduce the prevalence of these most contaminated chickens (greater than 1000 cfu/g) to below 10% at the end of the slaughter process, by the end of 2015. This equates to a level of 7% at retail owing to the natural 'die-off' of *Campylobacter* through the chill chain. While the target was not fully achieved across the industry by the end of 2015, the FSA is encouraged by the recent significant improvements in *Campylobacter* levels and has agreed to roll the target forward to 2016.

All chickens, regardless of which retail outlet they were bought from, are at risk of being contaminated with *Campylobacter*, which is why it is important for consumers to handle and cook their chicken safely. Effective cooking will kill any *Campylobacter* on the chicken.

Levels of contamination

The level of *Campylobacter* contamination on chicken skin is measured in terms of the number of colony forming units per gram of skin (cfu/g). Table 1 presents the levels of contamination found on chicken skin in Oct-Dec 2015, showing the proportion of chickens in various bands of contamination. Where the test of *Campylobacter* on chicken skin gives a result below 10 cfu/g we are unable to conclude that any *Campylobacter* is present. So, only levels of *Campylobacter* of 10 g/cfu and over are detectable.

- Detectable levels of *Campylobacter* are split into three bands: '10-99 cfu/g', '100-1000 cfu/g' and 'Over 1000 cfu/g'.
- The highest band ('Over 1000 cfu/g') is the primary focus of attention.

Table 1 – Levels of *Campylobacter* (cfu/g) on chicken skin: Oct – Dec 2015

Chicken skin	Level of <i>Campylobacter</i> contamination (cfu/g)			
	Less than 10	10-99	100-1000	Over 1000
Percentage of chickens	41.1 (37.5 - 44.6)	23.4 (20.3 - 26.6)	24.8 (21.7 - 28.0)	10.7 (8.6 - 13.0)
No. samples	400	221	241	104

95% confidence intervals are shown in brackets. These reflect the uncertainty in the given estimate, providing a range of values within which the true percentage will lie 95% of the time.

² Scientific Opinion on *Campylobacter* in broiler meat production: control options and performance objectives and/or targets at different stages of the food chain: www.efsa.europa.eu/en/efsajournal/doc/2105.pdf

- 58.9% of skin samples were positive for Campylobacter and 10.7% of skin samples showed levels of Campylobacter over 1000 cfu/g.

To measure Campylobacter contamination on the outer packaging of chickens at retail, a swab is thoroughly run over the entire outer surface of the packaging and tested. The level of Campylobacter contamination on packaging is therefore measured in terms of the number of colony forming units per swab (cfu/swab). The levels of contamination on the outer packaging in Oct-Dec 2015 are presented in Table 2.

- 5.7% of packaging samples were positive for Campylobacter and 0.1% of packaging samples had a level Campylobacter above 1000 cfu/swab.

Table 2 – Levels of Campylobacter (cfu/swab) on chicken packaging: Oct – Dec 2015

Chicken packaging	Level of Campylobacter contamination (cfu/swab)			
	Less than 10	10-99	100-1000	Over 1000
Percentage of chicken packaging	94.3 (92.6 - 95.9)	4.3 (2.9 - 5.8)	1.3 (0.5 - 2.3)	0.1 (0.0 - 0.2)
No. samples	910	44	11	1

95% confidence intervals are shown in brackets. These reflect the uncertainty in the estimate, providing a range of values within which the true percentage will lie 95% of the time.

Change over time

Three measures are used to summarise the extent of Campylobacter contamination in chickens at retail:

- The percentage of chicken skin samples positive for Campylobacter
- The percentage of skin samples with a level of Campylobacter over 1000 cfu/g
- The percentage of outer packaging samples positive for Campylobacter

Table 3 presents the latest results for the three summary measures of Campylobacter contamination in chickens at retail. It shows both the latest results (Oct-Dec 2015) as well as those for the same period last year (Oct-Dec 2014). Both sets of results are weighted using the same data on the market share of individual retailers and therefore do not take into account any changes in market share that may have occurred between the two periods.

- There was a statistically significant reduction in the percentage of chickens (skin samples) with high levels of Campylobacter over (1000 cfu/g) from 18.9% in Oct-Dec 2014 to 10.7% in Oct-Dec 2015 (see Figure 1).
- The prevalence of highly contaminated chickens was significantly lower in Oct-Dec 2015 (10.7%) than the previous quarter (14.9%). A similar fall was observed over the same period in 2014, so it is plausible that at least part of this reduction was a result of regular seasonal effects rather than new/ increased retailer interventions in Oct-Dec 2015.
- There was a statistically significant reduction in the percentage of chickens positive for Campylobacter from 74.3% in Oct-Dec 2014 to 58.9% in Oct-Dec 2015.

- The prevalence of chickens positive for Campylobacter was significantly lower in Oct-Dec 2015 (58.9%) than the previous quarter (76.3%). At least part of this reduction may be a result of regular seasonal effects.

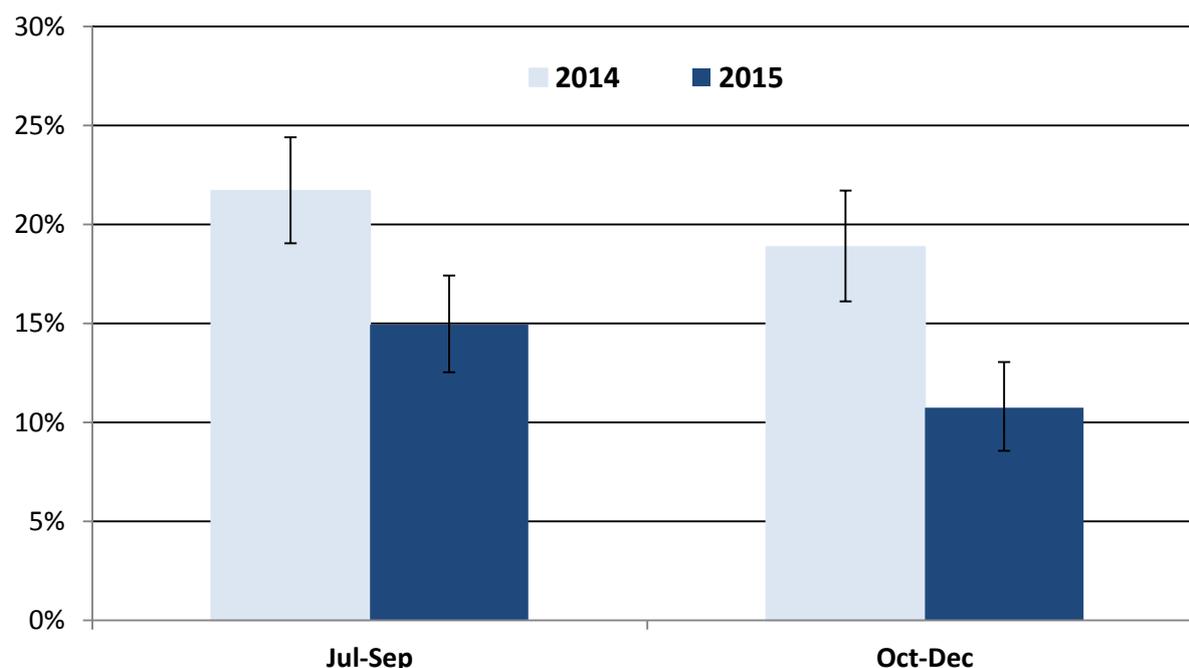
Table 3 – The overall prevalence of Campylobacter on chickens sampled and on the outside of the chicken packaging: Jul – Sep and Oct – Dec; 2014 and 2015

Time period	No. of samples	% skin samples positive for Campylobacter	% skin samples over 1000 cfu/g Campylobacter	% packaging samples positive for Campylobacter
2014				
Jul - Sep 14	1,162	83.4 (74.1 - 92.1)	21.7 (19.0 - 24.4)	8.8 (7.0 - 10.6)
Oct - Dec 14	928	74.3 (71.3 - 77.2)	18.9 (16.1 - 21.7)	7.3 (5.5 - 9.3)
2015				
Jul - Sep 15	1,032	76.3 (73.3 - 79.2)	14.9 (12.5 - 17.4)	6.4 (4.9 - 8.0)
Oct - Dec 15	966	58.9 (55.4 - 62.5)	10.7 (8.6 - 13.1)	5.7 (4.1 - 7.4)
Year 1 of the survey* (mid Feb 14 - mid Feb 15)	4,011	73.2 (71.7 - 74.6)	19.7 (18.3 - 21.1)	6.8 (5.9 - 7.7)

95% confidence intervals are shown in brackets. These reflect the uncertainty in the estimate, providing a range of values within which the true prevalence will lie 95% of the time.

* The results of Year 1 of the survey differ from those originally published in May 2014, as they are weighted based on more up to date data on the market share of each retailer. All prevalence estimates in this table are based on the same market share data.

Figure 1 – The percentage of chickens at retail with high levels of Campylobacter (over 1000 cfu/g): Jul – Sep and Oct – Dec; 2014 and 2015



95% confidence intervals are shown as vertical bars. These reflect the uncertainty in the estimate, providing a range of values within which the true prevalence will lie 95% of the time.

Results by retailer

Table 4 shows the latest results for the three summary measures of Campylobacter contamination in chickens at retail, by retailer. Figure 2 presents the percentage of skin samples with a level of Campylobacter over 1000 cfu/g, by retailer.

Both Table 4 and Figure 2 include 95% confidence intervals for each of the prevalence estimates (in Figure 4 these are represented as vertical bars). Where these overlap this suggests there may be insufficient data to draw firm conclusions about which has a lower prevalence for the given summary measure.

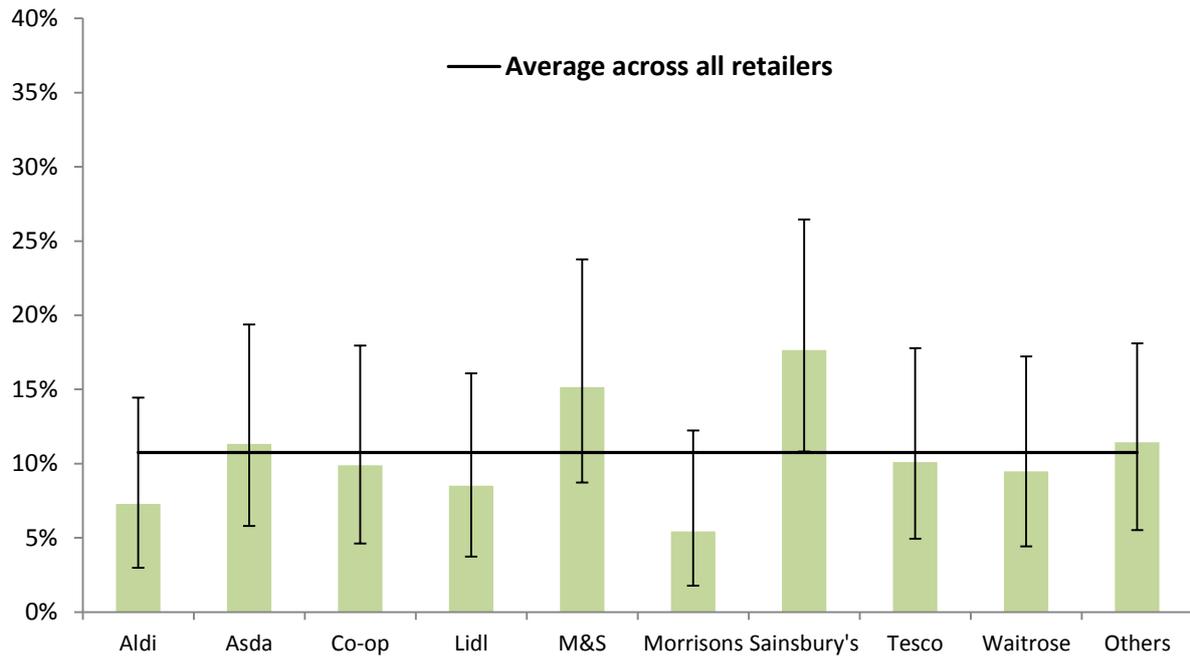
- For comparing the percentage of chickens with levels of Campylobacter above 1000 cfu/g between retailers, each retailer was compared to the overall average (weighted according to market share) among all other retailers:
 - The only named retailer which had a significantly lower prevalence compared to the average among all other retailers was Morrisons (5.4%).
 - The only named retailer which had a significantly higher prevalence compared to the average among all other retailers was Sainsbury's (17.6%).
- The only retailer to see a statistically significant change in its prevalence of highly contaminated chickens from the previous quarter was Morrisons (from 25.7% in Jul-Sep 2015 to 5.4% in Oct-Dec 2015). At least part of this reduction may be a result of regular seasonal effects.

Table 4 – The overall prevalence of Campylobacter on chickens sampled and on the outside of the chicken packaging, by retailer: Oct – Dec 2015

Retailer	No. of samples	% skin samples positive for Campylobacter	% skin samples over 1000 cfu/g Campylobacter	% packaging samples positive for Campylobacter
Aldi	96	62.5 (52.0 - 72.2)	7.3 (3.0 - 14.4)	4.2 (1.1 - 10.3)
Asda	97	60.8 (50.4 - 70.6)	11.3 (5.8 - 19.4)	6.2 (2.3 - 13.0)
Co-op	91	53.8 (43.1 - 64.4)	9.9 (4.6 - 17.9)	8.8 (3.9 - 16.6)
Lidl	94	64.9 (54.4 - 74.5)	8.5 (3.7 - 16.1)	9.6 (4.5 - 17.4)
M&S	99	54.5 (44.2 - 64.6)	15.2 (8.7 - 23.8)	3.0 (0.6 - 8.6)
Morrisons	92	45.7 (35.2 - 56.4)	5.4 (1.8 - 12.2)	3.3 (0.7 - 9.2)
Sainsbury's	102	65.7 (55.6 - 74.8)	17.6 (10.8 - 26.4)	5.9 (2.2 - 12.4)
Tesco	99	61.6 (51.3 - 71.2)	10.1 (5.0 - 17.8)	6.1 (2.3 - 12.7)
Waitrose	95	60.0 (49.4 - 69.9)	9.5 (4.4 - 17.2)	6.3 (2.4 - 13.2)
Others	101	56.3 (46.4 - 66.1)	11.4 (5.5 - 18.1)	5.5 (1.2 - 10.6)
All	966	58.9 (55.4 - 62.5)	10.7 (8.6 - 13.1)	5.7 (4.1 - 7.4)

95% confidence intervals are shown in brackets. These reflect the uncertainty in the estimate, providing a range of values within which the true prevalence will lie 95% of the time.

Figure 2 – The percentage of chickens with levels of Campylobacter over 1000 cfu/g by retailer: Oct – Dec 2015



95% confidence intervals are shown as vertical bars. These reflect the uncertainty in the estimate, providing a range of values within which the true prevalence will lie 95% of the time.

Methodological Annex

Eligibility criteria

Chickens eligible for inclusion in the survey are:

- Whole, chilled, raw, UK-produced standard, free range or organic chickens;
- Where contained in a package, it was unopened and undamaged;
- NOT frozen;
- NOT basted, herbed, stuffed, marinated or otherwise modified.

Samples are collected from retail premises (including both retailer own-brand and branded chickens) in the UK, and the information gathered, includes temperature on receipt, the approved premises code of the poultry plant and use-by dates.

Statistical features

This report includes prevalence estimates for the 9 retailers which have a market share greater than 4% - the 'named' retailers. All butchers and other smaller retailers are grouped together into an 'Others' category.

During the previous survey (Year 1, intended to represent the 12 month period starting mid-February 2014), chickens were sampled from retailers to reflect their market share, with a planned 4000 samples altogether. This was intended to estimate the overall mean prevalence of *Campylobacter* in fresh retail chickens in the UK over a full 12-month period.

The current survey (July 2015 – June 2016) is designed to give more robust prevalence estimates for individual named retailers, as well as to estimate the overall mean prevalence. To achieve this, a planned 400 chickens will be sampled from each of the 9 named retailers, with 200 for butchers and 200 for other smaller retailers. Adopting this design has a negligible effect on the precision of estimate for the overall mean prevalence, while resulting in better comparability between retailers. As with last year's survey, for each of the named retailers the split in terms of the types of chickens sampled (standard/ free-range/ organic) was based on the market share data.

To remove any bias from not sampling chickens according to market share, the survey data are weighted using the market share data. So the overall prevalence figures are a weighted average of the prevalence figures for each of the 9 named retailers, butchers and 'other smaller retailers'. The prevalence figures for the 'Others' category, are a weighted average of the prevalence figures for butchers and those for 'other smaller retailers'.

The market share data used were supplied by Kantar for the 52 weeks ending 1st February 2015 and are more up to date than the Kantar data used for the design of the Year 1 survey which referred to 2009/2010. As these data are a snapshot of a fixed period of time, they may not reflect the dynamic nature of the market. These data fulfil several criteria:

- They are derived from a large UK-wide consumer panel
- They are able to provide information specifically referring to chickens at retail which meet eligibility criteria for inclusion in the survey
- They provide breakdowns by type of chicken (standard, organic, free range)

Revised overall prevalence figures for Year 1, weighted based on the new market share data, are also included in this report, and they do not differ greatly from those originally published in May 2015.

Confidence intervals, for the estimated prevalence of individual retailers are exact confidence intervals. Since the estimates of the overall prevalence, and the estimates of prevalence for the “Others” category are weighted averages, bootstrap confidence intervals are used for these estimates.

Laboratory testing

The testing laboratories were the five Public Health England (PHE) Food, Water and Environmental Microbiology Laboratories, as well as the Agri-Food Biosciences Institute (AFBI) Laboratory in Northern Ireland. Once samples reached the laboratory, testing was initiated within 24 hours, and certainly before 48 hours after sampling. Chickens were tested before or on their use-by dates. Sampling and laboratory personnel prevented cross contamination between samples and from the surrounding environment at all stages, e.g. by wearing gloves and changing them between handling each chicken, and the cleaning of equipment and work surfaces after each sample.

Two samples for each chicken were analysed; one sample consisting of 25g homogenised skin (mainly neck-skin), and one sample representing the outer packaging (prepared by examining 1mL of liquid extracted from a Maximum Recovery Diluent (MRD)-wetted sponge swab thoroughly rubbed twice over the entire outer packaging of the chicken).

The chicken samples tested were examined utilising the enumeration method based on ISO/TS 10272-2:2006 Microbiology of food and animal feeding stuffs -- Horizontal method for detection and enumeration of *Campylobacter* spp. -- Part 2: Colony-count technique. Enumeration using direct plating with a detection limit of 10 colony forming units (cfu) per gram (g) of neck-skin, or per swab sample, was used.

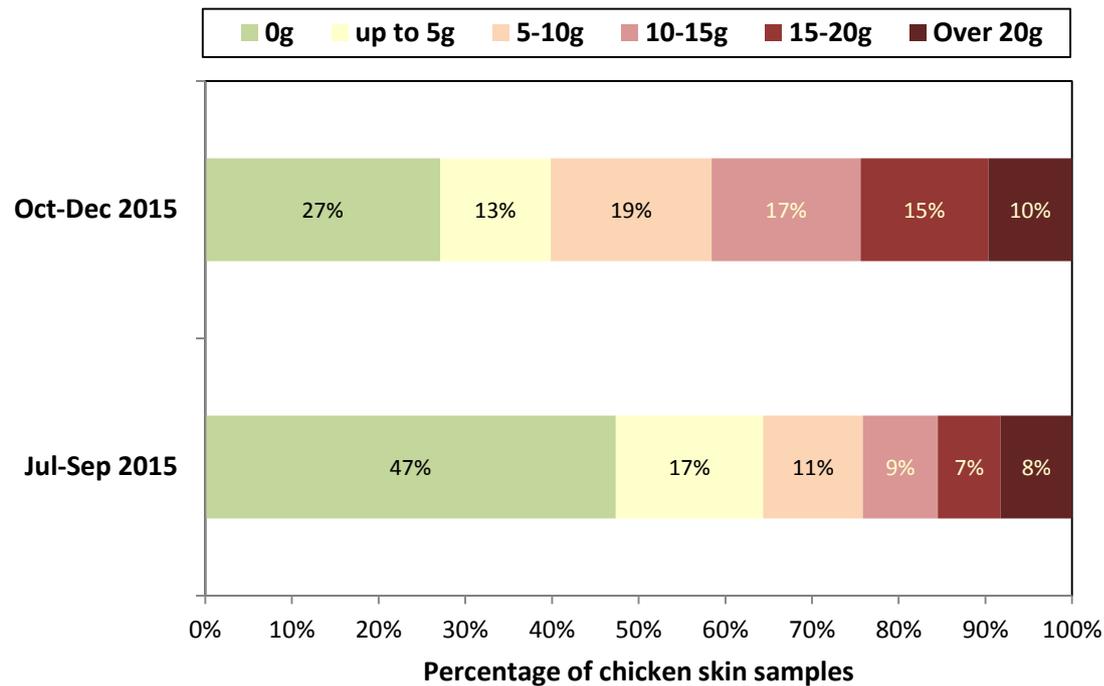
A methodological issue affecting the latest results

The protocol for measuring the level of *Campylobacter* contamination in chickens at retail aims to test a sample of 25g of the neck skin. This is in line with the principle of measuring *Campylobacter* levels on the most contaminated part of the chicken carcass. The protocol specifies that should 25g of neck skin not be available, the sample should be topped up with breast skin to make up the 25g.

As a result of the poultry industry’s intervention of trimming back the chicken neck skin, over recent months an increasing amount of breast skin has had to be used in the 25g chicken skin samples. The changes in the amount of breast skin used in the 25g samples between Jul-Sep 2015 and Oct-Dec 2015 are illustrated in Figure 3.

With the neck skin being the most contaminated part of the chicken carcass, its removal does (all else being equal) constitute an improvement in the level of contamination of chickens at retail. However this improvement may not be as large as reflected in our reported results, as the level of contamination on breast skin used instead, may not be as high as it is elsewhere on the carcass.

Figure 3 – The amount of breast skin used in the 25g chicken samples tested: Jul – Sep 2015 and Oct – Dec 2015



*Weighted by retailer market share

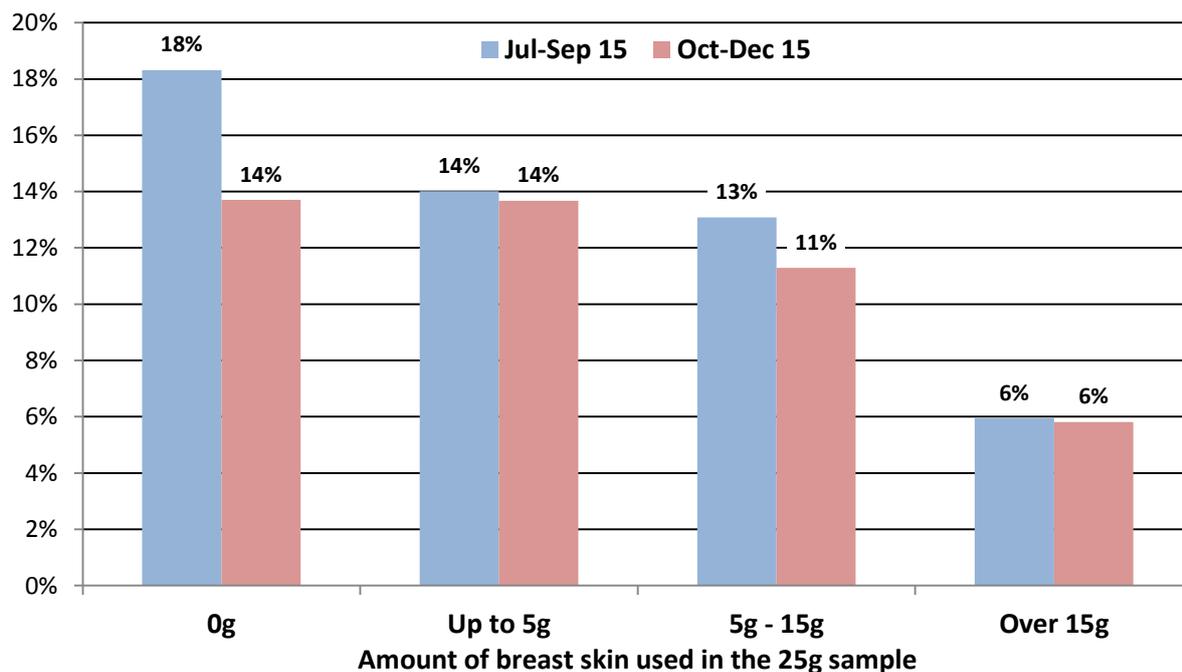
As such this trend of increasing trimming of neck skin, while being a positive development, is compromising our ability to make like-for-like comparisons over time, on the basis of the current survey protocol. In the same way, as the amount of breast skin which has to be used in the chicken samples has increased to a much larger degree for some retailers than for others, our ability to make like-for-like comparisons between retailers, is also being compromised.

If the breast skin was consistently the second most contaminated part of the chicken, then the practice of using breast skin to make up the remainder of 25g sample would be in line with the principle of enumerating the level of Campylobacter on the most contaminated part of the bird. The increasing use of breast skin in the sample over time, and differences in the amount of breast skin used between retailers, would then not pose as much of a problem in terms of our ability to make like-for-like comparisons. However this is not thought to be the case.

In terms of evidence from the survey, among chicken skin samples which contain more than 15g (out of 25g) of breast skin the proportion of results over 1000 cfu/g is lower than for samples with less than 15g of breast skin, as shown in Figure 4. This relationship persists after we attempt to control for differences in the retailer/plant the chickens were taken from and at what time of the year the chickens were sampled.

However this is not necessarily a reliable reflection of how the amount of breast skin used affects the observed prevalence, as there may be other unknown factors involved e.g. it could be the case that chickens which tend to have their neck skins trimmed are also more likely to be those which have been subjected to other interventions to reduce their level of Campylobacter. A reliable comparison of the levels of Campylobacter in breast skin and neck skin (or other parts of the chicken) would require samples to be compared which have been taken from the same chicken carcass.

Figure 4 – The percentage of chicken skin samples with high levels of Campylobacter (over 1000 cfu/g), by the amount of breast skin included in the 25g sample: Jul – Sep 2015 and Oct – Dec 2015



*Based on actual number of skin samples, not weighted by retailer market share

For the results published in the previous report (for the period Jul-Sep 2015), looking at only skin samples which contained no breast skin gave broadly similar results (in terms of the year on year change in the overall prevalence and the ranking of retailers) to those based on looking at all of the skin samples. However for Oct-Dec 2015 there were too few samples containing no breast skin, for individual retailers and not enough such samples overall to show significant differences over time. The exception to this is the proportion of skin samples positive for Campylobacter:

- Based on all skin samples there was a statistically significant reduction in the percentage of chickens positive for Campylobacter from 74.3% in Oct-Dec 2014 to 58.9% in Oct-Dec 2015. Looking only at the skin samples containing no breast skin there was also a statistically significant reduction over this period (from 79.8% to 70.2%).
- Based on all skin samples there was a statistically significant reduction in the percentage of chickens positive for Campylobacter from 76.3% in Jul-Sep 2015 to 58.9% in Oct-Dec 2015. Looking only at the skin samples containing no breast skin there was also a statistically significant reduction over this period (from 79.9% to 70.2%).

In terms of the over main measure of Campylobacter contamination in chicken (the percentage of skin samples with levels of Campylobacter over 1000 cfu/g), looking at only skin samples which contained no breast skin, for the two quarters of the current survey so far, gives similar year on year changes to those based on all skin samples (see Table 5).

Table 5 – The percentage of chicken with high levels of Campylobacter (over 1000 cfu/g) based on: all skin samples; and only those containing no breast skin

Year on year comparisons

	Based on all samples			Based on all samples containing no breast skin		
	2014	2015	Change	2014	2015	Change
Jul - Sep	21.7	14.9	-6.8 (-10.3 to -3.0)	24.3	18.4	-5.9 (-11.3 to -0.5)
Oct - Dec	18.9	10.7	-8.1 (-11.7 to -4.5)	24.2	16.4	-7.8 (-15.5 to 0.0)

Quarter to quarter comparison

	Based on all samples			Based on all samples containing no breast skin		
	Jul-Sep 15	Oct-Dec 15	Change	Jul-Sep 15	Oct-Dec 15	Change
2015	14.9	10.7	-4.2 (-0.9 to -7.5)	18.4	16.4	-2.0 (-9.0 to 5.4)

 = statistically significant change

95% confidence intervals are shown in brackets

The Food Standards Agency is considering options for addressing this issue, to enable like-for-like comparisons over time and between retailers in future editions of this report.

Further information

Additional information on the survey design can be found in the original survey protocol at: www.food.gov.uk/sites/default/files/Campylobacter%20Retail%20Survey%20Year%202%20protocol%20%28final%29.pdf

We aim to meet the needs of our users. If you have any feedback on this publication please send it to hiten.shah@foodstandards.gsi.gov.uk