
EMERGING FOOD TECHNOLOGIES: NOVEL PROTEIN SOURCES AS FOOD

Report by Alison Gleadle, Director of Food Safety

1 SUMMARY

- 1.1 This paper provides an overview of recent developments concerning the development of novel protein sources as food.
- 1.2 The Board is asked to:
 - Note that there is a clear requirement for all novel protein sources to undergo a premarket safety evaluation.
 - Note that horizon scanning exercises funded by the Food Standards Agency (FSA) indicate that the use of “*in vitro* meat” is not yet at a stage where it is commercially viable.
 - Note that there is increasing interest at global level in insects as a sustainable source of nutrition.
 - Note that, with our counterparts in other EU Member States, the FSA has recently responded to a request from the European Commission regarding the consumption of insects in the EU.

2 INTRODUCTION

- 2.1 At present, the best known novel alternative to meat as a protein source is a mycoprotein produced by the fungus *Fusarium venenatum*. This product was developed by Marlow Foods and, following a comprehensive safety evaluation by the UK regulatory authorities in the early 1980s, this product was first marketed in the UK in 1985 under the brand name *Quorn*. A wide range of food products containing *Quorn* are now available and the mycoprotein is now well established product in the UK and across the world and is consumed as a meat substitute.
- 2.2 Largely as a result of the view that *Quorn* should undergo an independent safety evaluation, UK Government encouraged industry to ensure that other ‘novel’ foods should undergo a similar assessment before being placed on the market in the UK. The assessment of such foods was initially carried out by the Advisory Committee on Irradiated and Novel Foods, which was replaced in 1989 by the Advisory Committee on Novel Foods and Processes (ACNFP). This voluntary procedure for the assessment of novel foods existed in the UK until 1997 when a European regulation came into force that established a harmonised approach for the assessment of all novel foods across the EU. The ACNFP continues to advise the FSA on all issues related to the safety of novel foods.

- 2.3 The FSA has commissioned three pieces of research (in 2004, 2005 and 2008) investigating the full range of new and emerging food technologies. The most recent of these studies, carried out by the Food Processing Faraday Partnership, makes reference to alternative sources of animal products, including meat obtained using cell culture techniques. The authors classified the likelihood of such products being commercially introduced within 10 years as “remote”, citing lack of consumer acceptance as the main factor.
- 2.4 This paper provides the Board with information on two novel protein sources – insects and “*in vitro*” or cultured meat – that have been the subject of recent media reports in the UK.

3 STRATEGIC AIMS

- 3.1 Work related to the regulation of novel sources of protein for food production meets strategic outcomes: Food produced or sold in the UK is safe to eat and imported food is safe to eat.

4 DISCUSSION

Regulation

- 4.1 The novel food regulation (EC) 258/97 requires that all foods and food ingredients that have not been consumed to a significant degree in the EU prior to 15 May 1997 undergo a premarket assessment and approval. This includes foods that have been consumed in some form or other in other parts of the world. The regulation has a deliberately broad scope and ensures that EU consumers are given the reassurance that any new food has undergone a stringent and independent safety assessment before it is placed on the market.
- 4.2 The FSA is the UK competent authority for novel foods and is advised on aspects related to their risk assessment by the ACNFP.
- 4.3 EU discussions on a proposal to replace and update the novel foods regulation ended unsuccessfully in March 2011. The Commission is due to issue a new proposal to restart the legislative process, possibly in early 2012. In addition to aligning the new regulation with the developments that have taken place in EU food law since 1997, the proposal is likely to correct an anomaly in respect of food consisting of whole animals, such as insects. This is covered in more detail in paragraph 4.11 below.

Novel sources of protein:

(a) Cultured meat

- 4.4 There is increasing press interest in the use of this technology, which makes use of stem cell techniques that were initially developed for medical purposes. Stem cells harvested from animals are cultured *in vitro* to produce large numbers of muscle cells, which can be made into a “meat-like” product. While there has been some success with this technique, the technology does

not currently enable meat to be produced in a recognisable form. While it is possible to produce cells that divide through many generations, these can only be formed in small groups as they lack the network of blood vessels that would be needed to carry nutrients into the body of a larger muscle mass.

- 4.5 The 2008 FSA-funded review of emerging food technologies did not identify ‘*in vitro* meat’ as a technology that is approaching commercial viability, referring to issues related to consumer acceptance of this type of product. The financial cost of cultured meat has also been highlighted in recent media reports. Press articles have referred to the cost of 500g ‘meat’ being around £212,000. Other figures suggest that the production of 250g ‘beef’ would cost in the region of \$1 million (£0.64m) although, with commercial backing, this could fall to £3500 per tonne, which is approximately twice the cost of conventional unsubsidised chicken meat production in the EU.
- 4.6 A recent review of the technology¹ points out that muscle tissue is highly metabolically active and *in vitro* production is hampered by the lack of the homeostatic mechanisms that remove metabolic products and provide a steady supply of nutrients *in vivo*. In addition to meeting the basic requirements for cell growth, the properties of normal muscle tissue rely on regular contraction of the muscles, which can be reproduced *in vitro* by electrical stimulation. While it may be possible to produce small quantities of meat-like tissue in the laboratory, scaling this up for commercial use presents significant challenges that are as yet unexplored. Also, a number of characteristics of conventional meat reflect metabolic reactions that take place post-slaughter and it is unknown whether the same reactions will occur in cultured meat. Overall, the review concludes that *in vitro* products are more likely to resemble processed and comminuted meat products, rather than traditional cuts of meat.
- 4.7 The most recent press reports indicate that researchers in the Netherlands believe the technology to be sufficiently advanced for trials to take place that would, for the first time, harvest cells and produce ‘meat’ that could be used in the production of a ‘sausage’. Given the cost of production, this appears to be a demonstration of the viability of the technology rather than a prelude to commercial production in the near future.
- 4.8 The use of stem cell technology for the production of food would be regarded as a novel process and food produced in this way could not be marketed without a premarket safety assessment and authorisation under the novel foods regulation (see paragraph 4.1 above).
- 4.9 No formal safety assessments appear to have been carried out for cultured meat products, presumably because the technology is not close to the market. The existing guidelines for the assessment of novel foods provide general guidance on the approaches that might be taken, including comparison with an existing counterpart.

¹ Datar M and Betti B (2010) Possibilities for an *in vitro* meat production system. *Innovative Food Science and Emerging Technologies* 11; 13-22

(b) Insects and insect protein

- 4.10 While insects have not traditionally been used for food in the UK or elsewhere in the European Union, it is estimated by the FAO that about 2.5 billion people across the world have diets that routinely include insects. While many insects are regarded as pests that hinder food production, the FAO is interested in promoting edible insects as a highly sustainable source of nutrition.
- 4.11 The European Commission has recently invited proposals for research into insects as an alternative source of dietary protein, including production efficiency, quality, safety and environmental impact. Contrary to press reports that this research is designed to encourage the consumption of insects in Europe, the research is in fact part of an international collaborative programme aimed at tackling Millennium Development Goals, particularly in relation to the goals of eradicating famine and ensuring environmental sustainability. Up to €1.5m of EU funding is available for this work. The deadline for research proposals is November 2011 and decisions on funding will be taken in 2012.
- 4.12 The novel foods regulation is designed to apply to all new foods before they are introduced into the EU, and this would include foods obtained from insects that have not been previously used as food sources in Europe. Due to an apparent oversight in the wording, however, the scope of the Regulation currently covers foods obtained from animals but it does not mention entire animals, such as grubs and insects. This anomaly is likely to be rectified when the Regulation is updated. In order to assess the impact of this change, the European Commission recently asked Member States to carry out a review and to report on the current use of insects as food. The FSA's contribution is summarised in the attached Annexe.
- 4.13 The European Commission is currently reviewing the replies from Member States and we await their consolidated response. The FSA's investigations have confirmed that a limited number of edible insect species are available in the UK, primarily advertised as "novelty" foods for curious or adventurous consumers rather than as staple foods. Based on our findings it appears that there has been low level of consumption of whole insects for several years, either by certain ethnic groups or as "novelty" products.
- 4.14 Although whole insects may be niche products in the UK, the use of purified or partially purified insect protein could have greater commercial viability, if a reliable source could be identified. This type of ingredient would require assessment and authorisation under the novel foods regulation.
- 4.15 In addition to questions about the presence of pathogenic microorganisms, the safety assessment of insect protein or other insect products would also have to consider a number of unique safety issues such as:
- The possible consequences of co-consuming venom (e.g. scorpion stings) that could give rise to serious adverse reactions in humans.

- The possibility of consuming foreign proteins leading to serious allergic reactions due to increased sensitisation. This issue was highlighted during the UK's recent risk assessment of bee venom as a novel food ingredient. At that time the ACNFP highlighted particular concerns for individuals who were unknowingly allergic to bee stings.
- The presence of known allergens carried over from the insects' feed and retained within their digestive tract.

(c) Other novel protein sources

4.16 As noted above, research into the use of cultured meat appears to be most advanced in the Netherlands, where there is a range of other research into new and sustainable protein-containing foods. This includes work on insect proteins, algal protein, and proteins obtained from plant or animal by-products (e.g. beet protein or bovine collagen).

5 CONCLUSION AND RECOMENDATIONS

5.1 The Board is asked to:

- note the above information about alternative dietary protein sources.

5.2 FSA officials will continue to monitor the introduction of novel protein sources and will update the Board of any significant developments.

For further information contact Sandy Lawrie on 020 7276 8565, email sandy.lawrie@foodstandards.gsi.gov.uk

Annexe

Edible Insect consumption in the UK

The FSA contacted UK-based insect suppliers and a number of other interested parties and trade organisations requesting information regarding the sale of insects in the UK (letter attached below).

The FSA also published the letter on its website, with an accompanying news story, inviting people submit information. This resulted in significant press interest with reports in UK newspapers and radio stations.

Nine responses were received. The majority did not offer any information but two respondents (both UK insect suppliers) were able to offer information about the following species of insects and spiders:

Insect	Availability in the UK	Additional notes
Chinese yellow scorpion (<i>Buthus marpens</i>).	since early 1990s.	sold coated in chocolate, in alcohol or in lollies
Mealworm (<i>Tenebrio molitor</i>).	for 20-30 years.	farmed in the US
Domestic cricket (<i>Acheta domestica</i>)	since early 1990s.	farmed in UK and US
Giant toasted ants (leaf cutter ants, <i>Attalaevigata</i> sp)	since 1996.	
Eggs of giant toasted ants (leaf cutter ants, <i>Attalaevigata</i> sp)	since 1996.	sold in brine
Black Asian Tarantula (<i>Halopelma nigra</i>).	since 1996.	
Mopani worms (<i>Imbrasia bellina</i>)	since 1996.	
Locusts	since 1996.	

Letter sent to interested parties

To: Interested Parties
By Email

12 August 2011

Edible Insect consumption: scope of the Novel Foods Regulation (EC) Regulation 258/97

Issue

The Food Standards Agency is inviting interested parties to submit any relevant information on consumption of whole insects and other animals, such as worms, within the UK, including information relating to the species that are currently sold in the UK and the duration and extent of sales. The aim is to identify any insects or other animals that have been introduced on to the UK market after 15 May 1997. The work will feed into a broader EU-wide investigation into the marketing of edible insects with all 27 EU Member States participating in this activity at a national level.

Background and context

Novel Foods are foods which have not been consumed to a significant degree within the EU before 15 May 1997. All novel foods are required to undergo a mandatory pre-market safety assessment and authorisation under the Novel Foods Regulation (EC) 258/97 before they can be legally marketed in the EU.

Insects and other whole animals are currently exempt from the scope of Regulation (EC) 258/97, largely due to an apparent oversight in the wording of the existing text. However, this situation will inevitably change with future

amendments to the Regulation, resulting in insects (etc) that are currently marketed as foods in the EU requiring a novel food safety assessment unless they have been consumed to a significant degree before 15 May 1997.

At the request of the European Commission, the Food Standards Agency (the UK Competent Authority for novel foods) is carrying out an investigation into insect consumption within the UK which will feed into the EU-wide investigation on this issue. The aim is to generate as comprehensive a list as possible of insects and other animals that may require a novel food safety assessment, so that appropriate transitional measures can be incorporated into the updated Regulation. We expect that discussions on the updated Regulation will take place during 2012.

To help with the UK investigations, the FSA is inviting interested parties to submit as much information as possible on insect consumption in the UK, including information relating to duration and extent of sales.

Any relevant information should be sent electronically to novelfoods@foodstandards.gsi.gov.uk by 31 August 2011. If you wish to submit information but are unable to meet this deadline, please contact the Novel Foods Unit at the Food Standards Agency as soon as possible and indicate when your information will be available.

Yours sincerely,

Dr Manisha Upadhyay
Novel Foods Unit, Food Standards Agency