Project number: 6455
Funding source: Department of Agriculture, Food and The Marine

Date: June 2020
Project dates: Dec 2012 - July 2018

Delivering processed meats with health benefits: Nutrimeat

Key external stakeholders:

Meat processors, consumers, ingredients companies, food retailers, regulatory agencies

Practical implications for stakeholders:

- This project demonstrated that meat products could be developed that have acceptable sensory quality attributes and the potential for nutrient and health claims.
- New product development provides a viable pathway for the meat sector in adapting to changes in consumer perspectives on meat and meat products.

Main results:

- Consumer attitudes to processed meats containing health promoting compounds were evaluated. In general, the focus group participants felt more uncertain than positive about the concept of functional meat. The limited number of products already on the market could help to explain this. Health perception and eating frequency of processed meat were associated with likelihood to purchase.
- A reduction of additives and preservatives, and in the salt and fat content were the strategies most supported by consumers towards making products healthier, followed by an increase in lean meat content. The use of natural forms of preservatives and flavourings and the addition of healthy ingredients were considered relatively less important. Consumers who were positive about salt and/or fat reduction were also positive about healthy ingredient enrichment.
- Low fat/low salt processed meat product formulations containing bioactive ingredients to enhance their healthiness were developed within the project. Most of these ingredients comply with European Food Safety Authority requirements for nutrient and health claims
- Microscopy and physicochemical analyses offered new insights into the food matrix properties associated with ingredient formulations, in particular the effects on texture.

Opportunity / Benefit:

There are new opportunities for the meat sector because the meat products developed within this project have the potential to meet changing consumer preferences for meat products. The product development strategies (reducing ingredients that may have negative associations, adding ingredients that may have positive associations) examined can be a template for the creation by industry of additional related products.

Collaborating Institutions:

UCD (Lead)
UCC

Contact Dr. Ruth Hamill Email: Ruth.Hamill@teagasc.ie.

Teagasc project team: Dr. Ruth Hamill
Prof. Aidan Moloney
Prof. Maeve Henchion
Dr. Song Miao

External collaborators: Prof. Frank Monahan (UCD) (PI)
Prof. Nigel Brunton (UCD)
Prof. Joseph Kerry (UCC)
Dr. Michael O'Grady (UCC)

1. Project background:

Meat is not generally thought of as a functional food despite its potential for delivery of functional ingredients in the diet of humans. Furthermore, all processed meats tend to get branded unfavourably despite the fact that they can be formulated to be healthy (e.g. low fat, low salt, minimal additives) and there are untapped opportunities to increase the level of ingredients with health promoting properties in processed meats. The overall aim of the project was to reduce "unhealthy" constituents while simultaneously increasing the level of desirable bioactive constituents in processed meat products thereby increase their "healthiness" and counteracting some of the negative associations that have emerged between processed meat products and consumer health.

2. Questions addressed by the project:

- The research adopted a tripartite approach of (i) evaluating consumer attitudes to processed meats containing health promoting bioactives, (ii) technically evaluating the potential to "match" healthy processed meat formulations with selected European Food Safety Authority (EFSA)-approved bioactives and (iii) conferring with industry partners on the feasibility of different product formulations.

- **The experimental studies:**

- The main studies focused on two types of product: reformed products (e.g. deli meats) and comminuted sausage-type products (e.g. breakfast sausage)
- For both product types, bioactives that already have EFSA-approved health claims associated with them were included. Although not (yet) EFSA-approved, commercial micro -DHA and macroalgae extracts (rich in omega 3 fatty acids) prepared from *Ascophyllum nodosum* were also investigated as potential functional food ingredients for sensory and technological performance.
- From a food processing perspective bioactive ingredients were chosen on the basis of "best fit" with the product type, for example alpha-linolenic acid inclusion was more suited to sausage-type products, which typically contain higher levels of fat than deli meats.
- Differential scanning calorimetry and imaging analysis of selected samples was also carried out.
- Consumer focus groups and an online survey (n=500) investigated consumer attitudes towards the developed products

- **Main results:**

The project set out to decrease the concentration of "unhealthy" constituents while simultaneously increasing the level of desirable bioactive constituents in processed meat products thereby increasing their healthiness for the consumer.

- Using a focus group approach, consumer attitudes to processed meats containing health promoting bioactive compounds were evaluated. Strategies that consumers felt as important for improving the health profiles of processed meat were dominated by using better quality meat and less salt, fat, preservatives and other chemicals. Regarding healthier meat formulations, they expressed divergent attitudes and concerns under four themes: (i) controversies around processed meat as the carrier of healthy ingredients; (ii) debates as to whether functional meat is 'actual' or 'pseudo' healthier; (iii) perceived value of functional meat to different consumers; (iv) trust and self-control in relation to healthy ingredients. In general, focus group participants felt more uncertain than positive about the idea of functional meat.
- An online survey of approximately 500 consumers explored consumer acceptability of healthy processed meats. Results showed that processed meats were not equally perceived as unhealthy. Consumers were in general more uncertain than positive about enriching processed meat with healthy ingredients. Purchase intention towards processed meat based functional foods was primarily driven by their attitudes, i.e. those who held stronger positive beliefs and less scepticism

Contact Dr. Ruth Hamill Email: Ruth.Hamill@teagasc.ie.

about the product concept were more likely to buy the product. Health perception and eating frequency of processed meat were also associated with an increased likelihood to purchase, i.e. frequent eaters of processed meat and those who viewed processed meats as 'not bad' or 'healthy' were more likely to buy the product.

- In terms of the strategies that consumers support to make processed meat healthier, results have shown that a reduction of additives and preservatives, and a reduction of salt and fat content were ranked first, followed by an increase in lean meat content. The use of natural forms of preservatives and flavourings and the addition of healthy ingredients were considered relatively less important. Consumers who were positive about salt and/or fat reduction were also positive about healthy ingredient enrichment.
- The project has developed low fat/low salt processed meat product formulations containing bioactive ingredients (most with which EFSA-approved nutrient and health claims could be associated) to enhance their healthiness. Bioactives investigated to date are vitamin E, plant sterols, alpha-linolenic acid (ALA), calcium, iron, hydroxytyrosol and microalgal oil and macroalgal extracts.
- Microscopy and physicochemical analyses offered new insights into the food matrix properties associated with ingredient formulations, in particular the effects on texture parameters such as hardness and their relationship with water content and fat encapsulation.

3. Opportunity/Benefit:

This research has a few implications in the meat industry. For instance, consumers' uncertainties about enriched processed meat as observed in this study is in contrast with their positive reaction towards salt and nitrite reduction as reported previously (Haugaard et al., 2014, Hung et al., 2016b). Also, according to EU regulations, food products containing excessive amount certain nutrients (e.g. fat, sugar, salt) should not carry nutritional or health claims for the added nutrient (European Commission, 2007). Together, these points imply that if healthy ingredient enrichment is to be carried out in processed meat, it should be combined with a reduction in less desirable ingredients to increase the likelihood of consumer acceptance and to permit the use of nutritional or health claims for marketing.

Processed meat products for which a health claim could potentially be made were developed:

- A turkey product containing plant sterols for which *High Protein, Low Fat* nutrient claims could be made and the following health claim could be made: *Plant sterols have been shown to lower/reduce blood cholesterol. High cholesterol is a risk factor in the development of CHD*.
- A chicken sausage with added omega-3 and vitamin E for which *High Protein, High in Omega-3, High in Vitamin E* nutrient claims could be made and the following health claims could be made: *"Alpha Linolenic Acid (ALA) contributes to the maintenance of normal blood cholesterol levels. The beneficial effect is obtained with a daily intake of 2g"* and *"Vitamin E contributes to the protection of cells from oxidative stress"*.

These products have the potential to support the meat sector in adapting to changes in consumer preferences for meat products. The product development strategies examined can be a template for the creation of additional related products.

4. Dissemination:

This project was showcased at a Teagasc Ashtown workshop entitled "Healthier Processed Meats: Fact or Fiction?" The project was selected for presentation at a UCD Institute of Food and Health Policy Seminar entitled "How can Public Policies change Food Systems to Promote Public Health?" A number of peer-reviewed publications, PhD theses, have emerged to date and aspects of the work were highlighted in poster and oral presentations at international conferences.

Main publications:

1. Shan, L.C., Henchion, M., De Brún, A., Murrin, C., Wall, P.G. and Monahan, F.J. (2017). Factors that predict consumer acceptance of enriched processed meats. Meat Science, 133,185-193.
2. Shan, L.C, De Brún, A., Henchion, M., Li, C., Murrin, C., Wall, P.G. and Monahan, F.J. (2017). Consumer evaluations of processed meat products reformulated to be healthier – A conjoint analysis study. Meat Science 131, 82–89.
3. Grasso, S., Brunton, N.P., Lyng, J.G., Harrison, S.M. and Monahan, F,J, (2016). Quality of deli-style turkey enriched with plant sterols. Food Science and Technology International. 22, 743-751.
4. Grasso, S., Monahan, F.J., Hutchings, S.C. and Brunton, N.P. (2017). The effect of health claim information disclosure on the sensory characteristics of plant sterol-enriched turkey as assessed using the Check-All-That-Apply (CATA) methodology. Food Quality and Preference, 57, 69-78.
5. Bolger, Z., Brunton, N.P., Lyng, J.G. and Monahan, F.J. (2016). Quality attributes and retention of vitamin E in reduced salt chicken sausages fortified with vitamin E. Journal of Food Science and

Contact Dr. Ruth Hamill Email: Ruth.Hamill@teagasc.ie.

Technology, 53, 3948-3959.
6. Shan, L.C., Regan, A., Monahan, F,J,, Li, C., Murrin, C., Lalor, F., Wall, P. and McConnon, A. (2016).Consumer views on 'healthier' processed meat. British Food Journal, 118(7): 1712-1730.
7. Bolger, Z., Brunton, N.P. and Monahan, F.J. (2017). Effect of mode of addition of flaxseed oil on the quality characteristics of chicken sausage containing vitamin E and omega 3 fatty acids at levels to support a health claim. Food and Function,8, 3563–3575
8. Bolger, Z., Brunton, NP and Monahan, FJ. (2018). Impact of inclusion of flaxseed oil (pre-emulsified or encapsulated) on the physical characteristics of chicken sausages. Journal of Food Engineering 230, 39- 48.

Popular publications:

1. Shan, L.C. (2017). Consumer attitudes towards and acceptance of 'healthier' processed meats. Oral presentation at: 'Healthier Processed Meats – Fact or Fiction' Workshop, February 16, 2017; Teagasc Ashtown, Dublin, Ireland.
2. Bolger, Z. (2017). Development of comminuted meat products with health benefits. Oral presentation at: 'Healthier Processed Meats – Fact or Fiction' Workshop, February 16, 2017; Teagasc Ashtown, Dublin, Ireland.
3. O'Grady, M. (2017). Development of processed beef and pork meat products containing health promoting marine derived ingredients. Oral presentation at: 'Healthier Processed Meats – Fact or Fiction' Workshop, February 16, 2017; Teagasc Ashtown, Dublin, Ireland.
4. Monahan, FJ, Lalor, F and Shan, C. (2018). Consumers and Reformulation of Healthier Processed Meats. Presented at the UCD Institute of Food and Health Policy Seminar entitled "How can Public Policies change Food Systems to Promote Public Health?" (November 15, 2018)

5. Compiled by: Dr. Ruth Hamill, Prof. Aidan Moloney, Prof. Maeve Henchion and Prof. Frank Monahan

Contact Dr. Ruth Hamill Email: Ruth.Hamill@teagasc.ie.