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## Studies on the microbiology and sensory properties of novel low sodium ethnic ready meals



### Key external stakeholders:

Food Manufacturers, cheese producers

### Practical implications for stakeholders:

- A ready-made meal salt reduction reformulation approach is feasible at manufacturing scale, when combined with microbiological and sensory optimization.
- A market survey revealed that salt levels in ready-made meals were  $\geq 50\%$  of the recommended daily allowances (RDA) for salt in 77% of meals evaluated, with 8 meals containing 100% of the RDA for salt.
- Market surveys also revealed that salt levels were not clearly labelled on most ready-made meals.
- The use of specific commercial salt replacers could facilitate further salt reductions in selected products.

The study has highlighted this it is possible to reduce sodium content in ready-made meals by 50-66% without comprising on quality.

### Main results:

- A comprehensive study was undertaken on the microbiological quality of commercial ready-made meals in comparison to reduced salt counterparts. No difference in microbiological populations was evident between ready-made meals with and without salt reduction over controlled storage conditions. This indicates that bacterial survival during commercial processing and frozen storage was not affected by the range of salt levels in full and reduced salt products.
- Evidence of bacterial migration during storage in Lasagne ready-made meals was demonstrated
- Salt levels could be reduced in selected ethnic ready meals by 29-50% without impacting on sensory quality. The difference was dependent upon the product type.
- The use of commercial salt replacers enabled a salt reduction of 48-66%.
- The impact of salt reduction on the quality of Cheddar cheese was assessed and highlighted that incorporating process changes could be used to lower salt levels without adversely impacting on quality.

### Opportunity / Benefit:

Extensive knowledge and expertise exists within the collaborating partners in relation to sodium reduction in ready-made meals and cheese that could be applied to other food products.

### Collaborating Institutions:

University of Limerick

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### 1. Project background:

Consumers are increasingly purchasing ready meals as a result of lifestyle pressures which leave less time available to prepare meals in the home. In Ireland the ready meals sector is an important component of the food industry and has experienced rapid expansion. However health agencies are increasingly concerned about the high intake of non-discretionary sodium from salt and sodium-containing additives in foods, including ready meals as excessive sodium intake is linked to hypertension, heart disease and stomach cancer. Sodium in the form of salt is added to food formulations for sensory, anti-microbial and product formulation purposes, thus reducing salt levels may adversely impact on product quality. However, little published information exists on salt levels in ready meals or the impact of salt reduction on product quality, and this project was designed to address these specific issues.

### 2. Questions addressed by the project:

- Are Irish consumers of ready meals aware of salt content in these products?
- What is Irish consumer's awareness of the RDA of salt?
- Can salt levels be reduced in ready meals without adversely impacting on quality or shelf life?
- What mechanisms exist to reduce salt levels in ready meals?
- Is labelling with regard to salt content sufficient on ready meals to enable consumers to make informed decisions?

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### 3. The experimental studies:

- The project focussed on the sodium reduction in three ethnic ready meals (chicken curry, lasagne & chilli con carne in conjunction with an industrial partner).
- The Microbiological content (species and enumeration) of regular and reduced salt meals was assessed at various storage conditions (4°C, 8°C & ambient temperature) over an 8 day period.
- The effect of salt (0-3% w/v) in broth media on the growth of spoilage bacteria commonly found in these products was assessed in controlled conditions.
- The migration of spoilage bacteria between different layers of lasagne was investigated to determine if the food structure of this type of product effected enumeration.
- The antibacterial properties of spice ingredients (extract of spice in ethanol or water) in ready meals were evaluated.
- The use of commercial salt replacers was assessed in three ready meals
- Surveys of Irish consumer of ready meals were undertaken to determine:
  - their awareness to salt levels in ready meals and in relation to RDA levels
  - the influence of salt content in relation to purchasing choice
- Sensory studies were undertaken to determine the influence of salt content on sensory perception of consumers of these ready meals.
- The impact of reducing salt on Cheddar cheese quality was assessed
- Development of a number of reduced salt ready meals

#### 4. Main results:

- No difference in microbiological populations was evident between ready-made meals with and without salt reduction over controlled storage conditions. This indicates that bacterial survival during commercial processing and frozen storage was not affected by the range of salt levels in full and reduced salt products.
- Evidence of bacterial migration during storage in Lasagna ready-made meals was demonstrated
- Salt levels could be reduced in selected ethnic ready meals by 29-50% without impacting on sensory quality. The difference was dependent upon the product type.
- The use of commercial salt replacers enabled a salt reduction of 48-66% in the three products tested.
- The impact of salt reduction on the quality of Cheddar cheese was assessed and highlighted that incorporating process changes could be used to lower salt levels without adversely impacting on quality.
- A cheese sauce with reduced salt content was developed.
- Even though consumers considered ready meals to be high in salt and unhealthy they continued to choose them as a regular food option.
- Salt labelling was unclear on most commercial products assessed.

#### 5. Opportunity/Benefit:

Consultancy and contract research opportunities are available to both national and international clients in salt reduction in process foods and cheese.

#### 6. Dissemination:

The information generated as part of this study was disseminated over the project lifespan on 48 occasions (workshops, conferences, symposia and meetings).

#### Main publications:

Guinee, T.P & O'Kennedy, B.T (2007). Reducing salt in cheese and dairy spreads. In *Reducing Salt in Foods*, eds D. Kilcast and F Angus. Woodhead Publishing Ltd, Cambridge, England, pp 316-357.

Durack, E., Alonso-Gomez, M & Wilkinson, M.G (2008). Salt: A Review of its Role in Food Science and Public Health. *Current Nutrition and Food Science*. 4, 290-297.

Mitchell, M., Brunton, N & Wilkinson, M.G (2008). Sodium and Ready Meals: A Survey of Irish Consumer awareness. *International Journal of Consumer Studies*, 36 (3), 317-326.

Mitchell, M., Brunton, N & Wilkinson, M (2009). Optimization of the sensory acceptability of a reduced salt model ready meal. *Journal of Sensory Studies*, 24(1), 133-147.

Mitchell, M., Nigel, P. B & Martin, G. W (2009). Sensory acceptability of a reformulated reduced salt frozen ready meal. *Journal of Foodservice*, 20(6), 298-308.

Edel Durack (2009), PhD Thesis – Studies on the microbiology of reduced salt frozen ethnic ready meals, University of Limerick.

Aleksandra Rulikowska (2009), MSc Thesis – Investigation of reduced salt content and the impact of starter-related differences in salt sensitivity on Cheddar cheese quality, University of Limerick.

Mitchell, M., Brunton, N and Wilkinson, M.G (2010). Current Salt reduction strategies and their effect on Sensory Acceptability: A study with reduced salt ready meals. *Journal of Food Service*, 20 (6), 298-308.

Michelle Mitchell (2011), PhD Thesis – Studies on the acceptability, sensory properties and consumer perception of reformulated reduced sodium ready-meals, University of Limerick.

Mitchell, M., Brunton, N & Wilkinson, M.G (2011). Current salt reduction strategies and their effect on sensory acceptability: A study with reduce salt ready meals. *European Food Research & Technology*, 232 (3), 529-539.

Durack, E., Alonso-Gomez, M & Wilkinson, M.G (2012). The effect of thawing and storage temperature on the microbial quality of commercial frozen ready meals and experimental reduce salt from ready meals. *Journal of Food Research*, 1 (2) 99-112.

Rulikowska, A., Kilcawley, K.N., Doolan, I.A., Alonso-Gomez, M., Nongonierma, A.B., Hannon, J.A & Wilkinson, M.G (2013). The impact of reduced sodium chloride content on Cheddar cheese quality. *International Dairy Journal*, 28 (2), 45-55.

Durack, E., Alonso-Gomez, M & Wilkinson, M.G (2013). The effect of salt reduction on the growth of food spoilage bacteria in model broth systems and salt adjusted ready meals. *Journal of Food Safety*, 33 (3), 302-312.

Wilkinson, M.G (2013). Sodium reduction in ready meals. *New Food*, 16 (6), 14,16-18.

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**7. Compiled by:** Kieran N Kilcawley

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