

Monitoring of Sodium and Potassium in Processed Foods

Period:

September 2003 to December 2018

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Acknowledgments

The Food Safety Authority of Ireland would like to acknowledge the role played by the Public Analyst Laboratory in Galway in providing the analysis of products sampled in all surveys between 2003 and 2018.

Abbreviations

AES	Atomic Emission Spectrophotometry
AOAC	American Association of Analytical Chemists
CRMs	Certified Reference Materials
EU	European Union
ESAN	European Salt Action Network
FSAI	Food Safety Authority of Ireland
FDII	Food and Drink Industry Ireland
INAB	Irish National Accreditation Board
K	Potassium
LOQ	Limit of Quantitation
Na	Sodium
NSD	No Significant Difference
PAL	Public Analyst Laboratory
PABA	Para-aminobenzoic acid
SRP	Salt Reduction Programme
SLÁN	National Survey Lifestyle, Attitudes & Nutrition
Std Dev	Standard Deviation
QC	Quality Control
WHO	World Health Organisation

Symbols

▼	Decrease
▲	Increase

Introduction

The relationship between salt intake *i.e. the sodium (Na) component of salt* and hypertension *i.e. high blood pressure* is well established and based on a large and growing body of evidence which includes clinical trials¹⁻⁴. As such reducing salt consumption in the Irish diet is important to help decrease the incidence of hypertension in the Irish population, the primary risk factor for cardiovascular disease. Cardiovascular disease includes heart attacks and strokes and is a leading cause of premature death and disability in Ireland⁵⁻⁶.

Salt Reduction Programme

Since 2003, the Food Safety Authority of Ireland (FSAI) has coordinated a salt reduction programme working in partnership with the food industry, Food and Drink Industry Ireland (FDII), Retail Ireland, various State bodies and organisations to achieve voluntary, gradual and sustained reductions in the salt content of processed foods⁷. Many other countries have also implemented similar salt reduction programmes⁸.

As part of the FSAI salt reduction programme, industry was asked to gradually decrease the average sodium value in their products together with improving production techniques to tighten the range of sodium values for a specific product *i.e. smaller standard deviation*. Hence some products within a wider product category would need to be reduced by a greater amount than other products. However, as some categories of processed food are bigger contributors to salt intake in the Irish diet than others, smaller reductions in these categories could provide a bigger impact on dietary intakes than larger reductions in smaller contributory categories⁷. The most recent estimates of the main contributors to salt intake in the Irish population are meat and fish (30%), of which 18% comes from cured/processed meats and bread (22%). Soups and sauces, milk and milk products and vegetables contribute 9%, 8% and 7% respectively⁹.

Monitoring

Coupled to the FSAI salt reduction programme has been an ongoing collaboration with the Public Analysts Laboratory (PAL) in Galway to monitor the levels of sodium and potassium across ten categories of processed foods. The data generated from this monitoring programme was initially used to support the FSAI salt reduction programme and provide evidence of industry commitments to salt reduction⁷. However, the data has also been used to support FSAI contributions to the WHO-EU Salt Action Network (ESAN)¹⁰, the European Union Framework on Voluntary National Salt Initiatives¹¹, the European Commission High Level Group on Nutrition and Physical Activity, tender procurement processes for food products by some state bodies, academic research and clinicians working with patients on low sodium or potassium diets.

The monitoring data collected by the FSAI has demonstrated that in some food categories such as bread and breakfast cereals, reformulation by the food industry has significantly reduced salt contents. However, reduction in salt across all categories of processed foods in particular processed meats has not achieved the expectations of the FSAI or the commitments of the food industry⁷.

Salt (Sodium) Intakes in Ireland

In 2005, the FSAI recommended through its “Salt and Health” report that an achievable salt intake target for the Irish population was 6g salt per/day (2.4g sodium)¹². Whilst the FSAI considers this an achievable target for the Irish population, it doesn’t regard it as an optimal or ideal level of consumption¹². The World Health Organisation (WHO) currently recommends a daily intake of 5g salt per/day for adults¹³. Furthermore, the physiological requirements for salt, although not well defined are estimated to be as low as 0.5g to 1.2g salt per/day *i.e.* 200-500 mg sodium/day most of which will be excreted via the kidneys^{1, 13}.

While reductions in the salt content of processed foods have been demonstrated by monitoring the assessment of dietary intakes to demonstrate the effects of salt reductions in processed foods on intakes, is more challenging. Dietary assessment using diary or recall methods⁹ can underestimate sodium intakes whereas 24 hour urinary sodium collections, considered to be the gold standard¹⁴, are challenging for participants and cannot identify precise sources of sodium in the diet¹⁵⁻¹⁶. Furthermore, the constantly changing composition of national and international food supplies indicates the need for more flexible and up-to-date methods to monitor population exposure to sodium¹⁵⁻¹⁶.

Estimates of the mean daily intake of salt for the Irish population from processed foods, excluding natural sources of sodium and discretionary salt *i.e.* salt added in cooking and at the table, have varied. Self-reported dietary salt intake levels (which exclude discretionary salt) estimated using the National Survey Lifestyle, Attitudes & Nutrition 2007 (SLÁN)¹⁷⁻¹⁸ food frequency questionnaire (n=9223) indicate average intakes of 8.1g/day for men and 7.6g/day per day for women¹⁴.

Spot urine sample analysis also from SLÁN¹⁷⁻¹⁸ corrected for urine volume (n=1207; Age ≥ 45 years), estimated average salt intake per day in adults aged over 45 years at 10.3 grams for men and 7.4 grams for women¹⁴. Estimates based on para-aminobenzoic Acid (PABA) validated 24-hour urine collections (n=599; Age 18-81 years), indicated a mean intake of 9.3 g/day with higher average intakes in men 10.4 g/day than in women, 7.4 g/day¹⁴ *i.e.* similar results to the spot urine test.

More recent estimates of salt intake for the Irish population provided through the “National Adult Nutrition Survey”⁹ (which exclude discretionary salt) indicate that among 18-64 year olds, mean daily intakes of salt from processed foods are 7.4g, with men (8.5g) having higher intakes than women (6.2g). Adults aged 65 years and over have an estimated mean daily salt intake of 6.3g, with men (7.3g) having higher intakes than women (5.4g)⁹.

In the 2013 Cork Children’s Lifestyle Study, over one thousand 3rd and 4th class children from 27 primary schools in Cork city and Mitchelstown had their the wellbeing, diet and exercise levels investigated. In almost half of the children salt intakes were above the maximum WHO recommended daily allowance of 5 g/day. Salt intake was also significantly higher in children who were overweight or obese compared to normal weight children¹⁹.

Moving Forward

The voluntary nature of the FSAI salt reduction programme has yielded some significant reductions in the salt content of foods. However, there has always been an emphasis for industry to take full responsibility for reducing salt in processed food. With the rising obesity epidemic there has been a move towards a more joined up approach at national, EU and international levels to not only reduce salt, but also unnecessary sugar and fats in our food.

In May 2013 the FSAI announced that the time was appropriate for the food industry to drive its own programme of reformulation of all foods. To facilitate this process, and other reformulation activities, the FDII has been developing a reformulation platform to drive this agenda forward and transfer the responsibility for realising future salt reduction to the food industry²⁰. This reformulation programme will also deal with reformulation of processed foods to reduce sugars, fats and energy.

In January 2016 FDII issued a first report estimating the impact of reformulation by some of its food industry members FDII on the Irish population²². This report provides a strong scientific platform to begin measuring the impact of reformulation by the industry going forward. However, coupled with this industry-led reformulation programme will be a continuation of the FSAI's independent surveillance and commentary on the commitments and achievements of the industry in relation to salt reduction. The FSAI must also continue to look at all options available to further reduce the salt content of processed food and reduce salt intake in the Irish population.

Since the 2005 Scientific Committee report on salt and health, the FSAI has advised against the use of potassium-based salt replacement ingredients to reduce the salt content of processed foods¹². The 2005 report raised concerns about the possible vulnerability of certain population sub-groups (including those with Type-1 diabetes, chronic renal insufficiency, end stage renal disease, severe heart failure and adrenal insufficiency) to a high potassium load from use of these salt substitutes in processed foods. It was also noted that the use of salt substitutes does not address the need to reduce the threshold for the taste of salt in the Irish population¹².

However, in April 2016 following extensive review, the Scientific Committee published a revision the 2005 report on salt and health in which it concludes that there is now scope for increased intake of potassium in the Irish diet through consumption of unprocessed or unrefined fruits, vegetables and nuts^{12, 23}. The use of potassium-based salt replacement ingredients by the food industry could also help supplement intakes of potassium by the Irish population²³.

The Scientific Committee also concluded that potassium-based salt replacement ingredients should only be used by the food industry where reduction of sodium could be detrimental to food safety and/or the physical or organoleptic properties of foods²³. Furthermore, potassium-based salt replacement ingredients should not be used for the sole purpose of flavour maintenance, i.e. saltiness or flavour enhancement. There continues to be a requirement for the food industry to work on reducing the salt taste thresholds of the Irish population²³.

With this in mind the FSAI in 2018 has begun work on developing guidelines for the food industry on the use of potassium and other mineral-based salt replacement ingredients during. These guidelines when issued will consider the following ²³:

- Possible effects of the use of these ingredients on vulnerable groups
- Types of replacement ingredients required by the food industry
- Types of foods in which these ingredients would be used and at what levels
- Likely reductions in salt levels in these foods
- Impact on actual sodium reduction in foods
- Impact on potassium intakes in the population.

General Notes on Tables Presented

1. Ten categories of processed food are sampled and monitored to determine mean levels of sodium and potassium. These categories of processed food are monitored at intervals which allow sufficient time for industry commitments on salt reduction to filter down into products available on the market. This is in line with the FSAI policy of gradual and sustained reductions in the salt content of processed foods. The interval for sampling typically ranges from 2 to 5 years
2. Values for sodium and potassium in processed foods from 2003 to 2010 were typically based on single product samples. However, since 2010 more representative sampling of products has been undertaken where possible. In this case a minimum of three samples of each selected product (with different batch numbers and/or shelf-life declarations) is sampled and tested for sodium and potassium
3. Some product formulations and labelling may have changed since these surveys were carried out. The analysis results presented in the tables reflect the situation at the time of product sampling
4. Where possible products are categorised based on their label description. In other cases products are categorised based on industry practice and/or legislative descriptors
5. Results relate to both branded and private label products
6. Results relate to products as sold (including those products requiring reconstitution before consumption e.g. dried soups)
7. All values are rounded to the nearest whole number
8. Statistical significance is the term used in assessing if a set of results/observations reflects a real pattern or one related to chance. In all tables statistical significance is set at $p=0.05$ (95%) confidence level (*t-test two tail assuming unequal variance*). All values are rounded to the nearest whole number.
9. Percentage reduction for sodium or potassium is only included in the tables where there is a statistically significant difference $p=0.05$ (95%) between the means of two surveys. For all others “No Significant Difference” (NSD) will be indicated in the tables. In some cases where NSD is indicated the size of the surveys did not provide sufficient power to be 95% confident that there was a difference between the mean values of two surveys.
10. Many publications will refer to sodium levels or intakes as either mass or millimolar (mmol) amounts of sodium, or mass of sodium chloride (salt) *i.e.* $1\text{g sodium chloride} = 17.1\text{ mmol amounts of sodium or }393.4\text{ mg of sodium}$. In all tables presented sodium values are in milligrams per/100g unless otherwise indicated.
11. To convert sodium to salt: **Multiply value by 2.54**
12. To convert salt to sodium: **Divide value by 2.54.**

Notes on Methodology of Analysis

1. All samples were analysed at the Public Analyst's Laboratory - Galway [INAB Registration Number: 009T](#)
2. Samples are initially homogenised either directly or as aqueous slurries (dependent on sample type) dried and then ashed in a muffle furnace ($520^{\circ}\text{C} \pm 20^{\circ}\text{C}$). Nitric acid is added to the ash and is acid-digested on a steam bath. The solution is then diluted (if necessary) and analysed for sodium and potassium using flame photometry (AES= Atomic Emission Spectrophotometry). Quality control (QC) checks are applied as part of monitoring method performance including internal and external QC, analysis of certified reference materials (CRMs) and repeatability. *In-House method 1/40 based on AOAC Official Method 969.23 (AOAC Official Methods of Analysis - 18th Edition, 2005)*
3. Methodology for laboratory analysis of food products for nutritional declarations such as sodium is not defined in legislation. Many methodologies of laboratory analysis are available with different degrees of accuracy and applicability. However, allowances for differences between methodologies for analysis of food products are not applied to the current results
4. The Limit of Quantitation (LOQ) for samples tested was 10mg/100g for both sodium and potassium and was dependent on the initial sample weight taken for analysis.
5. Average sodium recovery was 92% (range 84 - 100%) based on combined CRM data (using NIST 1546 Meat & LGC 7103 Biscuit Reference Materials & External QC Data from Proficiency Testing Schemes).
6. Average potassium recovery was 95% (range 92 - 104%) based on combined CRM data (using NIST 1546 Meat & LGC 7103 Biscuit Reference Materials).

Summary of Recent Updates December 2018

Bread Products (Tables 6 and 17)

This was the first survey of bread products since 2015. A total of 97 individual bread products were sampled across 5 of 7 identified bread categories. All samples were analysed for both sodium and potassium.

1. Of the 97 products, 46% were own label supermarket brands from all the major retailers on the Irish market and 54% were branded samples, which included products from independent bakeries.
2. Of the 97 products, 89% were manufactured in Ireland and 11% in the United Kingdom, including Northern Ireland.
3. In relation to nutritional declarations all 97 products had labelled salt contents. 83% (81/97) of products had a declared salt content of < 1.25g/100g and 17% (16/97) had a declared salt content of > 1.25g/100g.
4. In analysing the accuracy of these declarations using the [European Commission guidance on tolerances for nutrient values declared on a label \[i.e. < 1.25g Salt per/100g ± 0.375 g; > 1.25g Salt per/100g ± 20%\]](#) 9% (9/97) of products had salt declarations outside the recommended tolerances. Of those outside the recommended tolerances, 4% (4/97) under-declared and 5% (5/97) over-declared salt contents in the products.
5. No significant change in sodium or potassium contents of mixed flour bread products between 2011 and 2018.
6. No significant change in the sodium content of brown bread products between 2003 and 2018.
7. No significant change in the potassium content of white and wholemeal bread products between 2003 and 2018.
8. A 13% reduction in the average sodium content of white bread from 535 to 465 *mg/sodium per/100g* between 2003 and 2018.
9. A 27% reduction in the average sodium content of wholemeal bread from 595 to 432 *mg/sodium per/100g* between 2003 and 2018.
10. A 29% reduction in the average sodium content of wholegrain bread from 588 to 418 *mg/sodium per/100g* between 2003 and 2018.
11. A 23% reduction in the average potassium content of brown bread from 251 to 194 *mg/potassium per/100g* between 2003 and 2018.
12. A 13% reduction in the average potassium content of wholegrain bread from 232 to 202 *mg/potassium per/100g* between 2003 and 2018.

- 13.** Of the 97 products taken in the 2018 survey 29% had a determined salt content of $\leq 1.0\text{g}/100\text{g}$ salt; 43% between 1.0 and 1.25g/100g salt and 28% $> 1.25\text{g}/100\text{g}$ salt.
- 14.** Of the 97 products taken in the 2018 survey the lowest determined salt content was 0.60g/100g salt in an own label (wheat-free) white bread while the highest was 1.68g/100g salt in a branded white Polish style bread.

Overview of Sample Numbers: FSAI Salt Surveys 2003 to 2018

Category	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Soups			126					114			42	103			44		429
Ready Meals		51					51					181					283
Cooking Sauces		52					71			48				88			259
Snack Products				136		97			137		102			59			531
Processed Meats		267		194			98			127			148				834
Bread Products	100			178					186		123		142			97 ^e	826
Breakfast Cereals	88 ^c					119			330				150				687
Spreadable Fats						72				90			90				252
Natural Cheese							34			56						93 ^d	183
Processed Cheese							36					173					209
Condiments															157		157
Unreported Data ^a		122	82	12			2										218
Total^b	188	492	208	520	191	97	292	114	743	231	267	457	530	147	201	190	4868

^a Unreported data relates to: Processed meat products 2004 (n=122), 2006 (n=12) and 2009 (n=2). Many of these products were cooked before analysis or didn't fit into a processed meat category. Unreported data also relates to a 2005 (n=82) survey of baby foods. All unreported data is available on request to the FSAI; ^b Total number of individual samples analysed including unreported data. **Note:** Number of distinct products may be less than this value; ^c Includes 5 repeat samples of cornflake based cereals, carried out in 2004; ^d Cheddar Cheese sampled on 23rd May 2018; ^e Bread sampled on the 23rd and 24th July 2018.

Data on Sodium:

Table 1 Soup Products (Sodium in mg/100g)

Category ^a	Mean Sodium Per Year of Survey (Standard Deviation) [Range]				t-test ($\alpha = 0.05$)	% Sodium Change
	2005	2010	2013/2014	2017 ^h	2005 to 2017 ⁱ	
Fresh Soup ^b	280 (76) [183 - 471]	230 (66) [90 - 380]	246 ^f (57) [160 - 380]	NT	0.05 (2005 v 2013)	▼ 12 (2005 v 2013)
Ambient Soup ^c	277 (65) [202 - 433]	251 (77) [130 - 370]	NT	241 (66) [150 - 340]	NSD	NSD
Canned Soup ^d	362 (123) [208 - 641]	268 (118) [140 - 590]	324 ^f (118) [190 - 550]	242 (64) [160 - 440]	< 0.05	▼ 33
Dried Soup ^e	4083 (1370) [1876 - 8609]	3320 (1055) [1430 - 6400]	3062 ^g (806) [803 - 4490]	NT	< 0.05 (2005 v 2014)	▼ 25 (2005 v 2014)
Total Samples	126	114	145	44	Overall Total = 429	

^a Unless otherwise indicated all samples were analysed as sold. Varieties of soup sampled within each category: Mushroom, Vegetable, Tomato and Chicken.

^b Chilled soup

^c Includes ambient soups packed in both flexible retort packs, pouches, tetra-packs and plastic pots

^d Some canned/tinned soups are condensed and diluted before cooking/consumption (dilution varies by manufacturer)

^e Includes both dried packet, dried instant and concentrated liquid varieties. Dried and concentrated soups are diluted before cooking/consumption (dilution varies by manufacturer).

^f Samples taken in May and October 2013

^g Samples taken from April to May 2014

^h Samples taken in August 2017

ⁱ Except were indicated.

Table 2 Ready Meals (Sodium in mg/100g)

Category ^a	Mean Sodium Per Year of Survey (Standard Deviation) [Range]			t-test ($\alpha = 0.05$)	% Sodium Change
	2004	2009	2014	2004 to 2014	
Oriental Dishes ^b	203 (148) [76 - 453]	193 (76) [100 - 310]	203 (74) [90 - 390]	NSD	NSD
Pasta Dishes ^c	298 (72) [121 - 400]	231 (68) [140 - 370]	222 (81) [40 - 380]	< 0.05	▼ 26
Curry Dishes ^d	276 (140) [147 - 637]	224 (85) [70 - 340]	215 (61) [120 - 330]	< 0.05	▼ 22
Pizza ^e	NT	NT	370 (96) [250 - 640]	NA	NA
Meat Pies ^f	364 (140) [178 - 524]	248 (79) [110 - 350]	NT	0.05 (2004 v 2009)	▼ 32 (2004 v 2009)
Quiche ^g	398 (153) [115 - 493]	308 (82) [200 - 410]	NT	NSD (2004 v 2009)	NSD (2004 v 2009)
Total Samples	51	51	181	Overall Total = 283	

^a May include chilled and/or frozen samples

^b May include Chicken, Beef or Pork Sweet & Sour, Black Bean, Chow Mein, Noodle Dishes and others

^c May include Lasagne (Beef, Pork or Vegetarian), Cannelloni and others

^d May include Indian, Thai and Chinese Chicken, Beef or Pork curries such as Tikka, Korma, Bhuna, Balti, Masala, Tandoori, Green & Red Curry and others

^e New Category for 2014: samples include only Cheese and Margarita varieties

^f May include Shepherds, Cottage, Steak & Kidney and Steak and one sample of beef stew for 2004 (Discontinued Sampling Category)

^g Typically Quiche Lorraine (Discontinued Sampling Category)

Table 3 **Cooking Sauces** (Sodium in mg/100g)

Category ^a	Mean Sodium Per Year of Survey (Standard Deviation) [Range]				t-test ($\alpha = 0.05$)	% Sodium Change
	2004	2009	2012	2016	2004 to 2016 ^e	
Carbonara ^b	444 (137) [266 - 586]	443 (92) [290 - 550]	Not Tested	286 (85) [170 - 500]	< 0.05	▼ 36
Bolognese ^c	412 (105) [201 - 524]	362 (160) [60 - 630]	270 (86) [150 - 470]	352 (219) [10 - 970]	NSD	NSD
Curry ^d	505 (118) [243 - 710]	353 (131) [140 - 580]	316 (77) [210 - 570]	331 (121) [170 - 590]	< 0.05	▼ 65
Sweet & Sour	379 (197) [188 - 865]	340 (163) [180 - 810]	270 (96) [160 - 510]	260 (56) [180 - 340]	< 0.05	▼ 69
Black Bean	1635 (1258) [649 - 4324]	706 (329) [330 - 1440]	472 (235) [260 - 840]	NT	< 0.05 ^g	▼ 71 ^g
Total Samples	52	71	48	88 ^f	Overall Total = 259	

^a Includes jarred, pouch and other forms of ambient packaged samples. No fresh cooking sauces were sampled

^b Cream based pasta sauces

^c Tomato based pasta sauces and included in 2016, red pesto sauces

^d Includes different varieties of curry sauce such as Tikka, Korma, Bhuna, Balti, Masala and Tandoori

^e Unless otherwise stated

^f Omitted Black Bean (n=2); Chilli Con Carne (n=3); Chow Mein (n=2); Hoi Sin (n=1); Thai Curry (n=2). All omitted results are available on request to the FSAI

^g Percentage sodium reduction between 2004 and 2012

Table 4 Snacks (Sodium in mg/100g)

Category	Mean Sodium Per Year of Survey (Standard Deviation) [Range]					t-test ($\alpha = 0.05$)	% Sodium Change
	2006	2008	2011	2013	2016	2006 to 2016 ^e	
Corn Chips	435 (171) [150 - 710]	493 (248) [200 - 1000]	507 (156) [280 - 670]	NT	NT	NSD (2006 v 2011)	NSD (2006 v 2011)
Extruded Snacks ^a	1036 (433) [190 - 2120]	895 (371) [520 - 1930]	1006 (161) [740 - 1230]	984 (277) [380 - 1430]	1030 (227) [690 - 1530]	NSD	NSD
Luxury Crisps ^b	685 (280) [350 - 1230]	543 (134) [360 - 780]	380 (135) [200 - 550]	NT	NT	< 0.05 (2006 v 2011)	▼ 45 (2006 v 2011)
Pelleted Snacks ^c	846 (416) [250 - 1580]	778 (424) [220 - 1740]	778 (108) [680 - 930]	737 (87) [640 - 810]	755 (21) [740 - 770]	NSD	NSD
Popcorn	796 (530) [360 - 1690]	575 (450) [240 - 1440]	758 (398) [380 - 1140]	NT	NT	NSD (2006 v 2011)	NSD (2006 v 2011)
Potato Crisps ^{b, d}	588 (262) [240 - 1230]	479 (222) [50 - 1320]	534 (120) [310 - 780]	557 (135) [200 - 960]	540 (179) [340 - 940]	NSD	NSD
Salt & Vinegar Products	890 (355) [500 - 1840]	836 (253) [530 - 1430]	759 (180) [290 - 1130]	865 (275) [330 - 1940]	794 (217) [510 - 1340]	NSD	NSD
Total Samples	136	97	137	102	59	Overall Total = 531	

^a Food extrusion is a process in which a food material is forced to flow, under one or more varieties of conditions of mixing, heating and shear, through a die which is designed to form and/or puff-dry the ingredients **e.g. onion rings** can be described as puffed snacks also. There are many different raw materials which can be used for extruded snack production including potato, rice, maize, wheat, corn etc.

^b Potato (of various varieties) which are sliced (flat, crinkle cut etc), lightly fried in vegetable oil and then sprinkled with flavouring

^c There are many different raw materials which can be used for pellet production such as; potato, rice, maize, wheat, corn etc. The pellets are divided into two basic categories, those made from grain (rice, maize, wheat, corn) or those made from potato. The latter being the only one to give the authentic potato taste to

the finished product. Pelletised snacks are produced when the raw material is extruded into a recognisable shape, this can be done using a process known as direct expansion or alternatively using a process known as indirect expansion. The direct expanded pellets are produced in a one-step extruder and are ready for consumption following the extrusion process. The indirect expanded pellets are extruded and then generally sold on as a semi-manufactured product to companies who finish the process by frying them in hot oil then dosing them with flavouring or seasoning before packaging

^d The majority of potato crisps sampled were Cheese and Onion flavour or variations of that flavour

^e Unless otherwise stated.

Table 5 Processed Meats (*Sodium in mg/100g*)

Category ^a	Mean Sodium Per Year of Survey (Standard Deviation) [Range]					t-test ($\alpha = 0.05$)	% Sodium Change
	2004	2006	2009	2012	2015	2004 to 2015	
Sausages ^b	881 (235) [479 - 1656]	950 (243) [260 - 1370]	810 (101) [650 - 1020]	823 (135) [590 - 1050]	782 (170) [420 - 1110]	< 0.05	11 ▼
Rashers ^c	1315 (312) [650 - 2040]	1098 (297) [610 - 1840]	1150 (144) [830 - 1400]	1132 (365) [580 - 2230]	957 (185) [550 - 1310]	< 0.05	27 ▼
Pudding ^d	868 (237) [517 - 1159]	670 (160) [300 - 910]	771 (145) [460 - 950]	832 (166) [520 - 1190]	745 (135) [510 - 1030]	NSD	NSD
Cooked Ham ^e	985 (240) [592 - 1503]	938 (162) [540 - 1230]	679 (260) [300 - 1140]	967 (125) [680 - 1150]	840 (132) [590 - 1170]	< 0.05	15 ▼
Total Samples	267^f	194^g	98^h	127	148	Overall Total = 834	

^a Unless otherwise indicated all samples were analysed as sold *i.e. raw*. Unreported data outlined in Table 1 is not presented in Table 6

^b Includes both pork and beef sausages

^c Rashers of bacon are cured pork and may come from any part of the pig and maybe smoked or unsmoked *i.e. green*. The majority of samples analysed in the FSAI surveys were back and streaky rashers.

^d Includes both white and black varieties of traditional Irish blood puddings

^e Ham is traditionally the cured product taken from the upper leg and buttock of the pig. However, the majority of samples analysed in the FSAI surveys were pre-sliced reformed or restructured hams including varieties such as crumbed, smoked, honey roast, deli and traditional which were loose, modified atmosphere or vacuum packed.

^f Results for Cooked Sausages (n=12); Bratwurst Sausage (n=1); Cooked Gammon Ham (n=15); Cooked Pudding (n=23); Cooked Burgers (n=9); Vegetarian Burger (n=1); Cooked rashers (n=55); Savoury Steak (n=2); Hot Dogs in Brine (n=1); Canned Cooked Ham (n=3); Raw Burgers (n=71); Gammon Ham (n=4); Cooked Beef (n=2) are omitted from results shown above. However, all omitted results are available on request to the FSAI.

^g Results for Cooked Sausages (n=2); Polish Sausage (n=1); Turkey Sausage (n=1); Cooked Rashers (n=3); Cooked Burgers (n=3); Turkey Rashers (n=2); Raw Burgers (n=7); Gammon Ham (n=8); Cooked Poultry (n=13) Cooked Beef (n=6); Miscellaneous (n=7) are omitted from results shown above. However, all omitted results are available on request to the FSAI.

^h Results for Chicken Sausages (n=1); Cooked Burgers (n=1); Raw Burgers (n=9); Gammon Ham (n=20) are omitted from results shown above. However, all omitted results are available on request to the FSAI.

Table 6 Bread Products (Sodium in mg/100g)

Category ^a	Mean Sodium Per Year of Survey (Standard Deviation) [Range]						t-test ($\alpha = 0.05$)	% Sodium Change
	2003	2006	2011	2013	2015	2018	2003 to 2018 ⁱ	
White ^b	535 (71) [460 - 702]	491 (81) [337 - 724]	438 (84) [260 - 640]	438 (33) [340 - 520]	443 (89) [300 - 620]	465 (99) [238 - 622]	< 0.05	13 ▼
Brown ^c	534 (133) [400 - 945]	449 (45) [339 - 524]	490 (78) [350 - 630]	428 (57) [350 - 560]	499 (59) [400 - 600]	483 (84) [322 - 618]	NSD	NSD
Wholemeal ^d	595 (140) [427 - 876]	456 (61) [356 - 564]	478 (101) [330 - 840]	419 (69) [300 - 600]	449 (70) [320 - 560]	432 (86) [290 - 590]	< 0.05	27 ▼
Wholegrain ^e	588 (235) [171 - 940]	NT	457 (89) [250 - 610]	NT	419 (20) [390 - 460]	418 (73) [291 - 611]	< 0.05	29 ▼
Speciality ^f	634 (137) [450 - 892]	NT	416 (77) [360 - 550]	NT	370 (29) [320 - 390]	NT	NA	NA
Mixed Flour ^g	NT	NT	408 (39) [360 - 470]	393 (48) [340 - 450]	399 (38) [360 - 470]	386 (67) [293 - 478]	NSD (2011 v 2018)	NSD (2011 v 2018)
Unpackaged ^h	NT	NT	NT	NT	407 (42) [240 - 740]	NT	NA	NA
Total Samples	100	178	186	123	142	97	Overall Total = 826 ^j	

^a 2003 samples taken September 2003; 2006 samples taken November 2005 to January 2006; 2010/11 samples taken July 2010, January 2011 and September 2011. Three samples representing three distinct batches and/or best-before dates were taken for 37 plant (industrial) bakery products in the 2011 survey.

Data on the sodium content of soda breads is available on request for the years 2003, 2006 and 2011 (**n=68**). Soda Breads include all varieties which include “soda” in their description including white and brown varieties. Some products did not include soda on the name/label but soda/sodium bicarbonate was included in ingredients, hence including it in this category

Data on the sodium content of bread rolls is available on request for the years 2003, 2006 and 2011 (**n=57**). Rolls include white and brown varieties of products such as Burger Buns, Baps, Baguettes, and Hot Dog Rolls etc.

^b White Breads include all varieties which include “**white**” in their main description such as Batch, Scotch Batch, Loaf, Barrell, Turnover, Bloomer, Pan, Chleb Malopolski, Kings Bread, Crusty and Cob, excluding soda breads

^c Brown Breads include all varieties which include “**brown**” in their main description such as Batch, Loaf, Hi-Fibre, Wheatgerm, Wholegrain, Barrell, Multigrain, Crusty and Pan, excluding soda breads

^d Wholemeal Breads include all varieties which include “**wholemeal**” in their description and/or include descriptions such as Stoneground, Hi-Fibre, Wheaten, Wheat, Wholewheat, Granary, excluding soda breads

^e Wholegrain Breads include all varieties which include “**wholegrain**” in their description and/or include descriptions such as Multigrain, Healthy-Grain, Granary Malted, Granary, Cob, Rye, Scotch Batch, Malted, Rustic Grain, Nutty, Stoneground, Hi-Fibre, Kibbled, Wholewheat, Cracked Wheat, Scotch Batch, Multigrain and Paco Granary, excluding soda breads

^f Speciality Breads include Ciabatta, Panini, Pitta Breads, Bagels, Corn Bread, Melba toast, Crumpets, Croissants and Procea

^g Mixed Flour Breads are those varieties which mix white, wholemeal or brown flours together. Products in this category are described as “**Best of Both**”, “**50:50 White**”, “**Two in One**” or “**Goodness of Both**” etc.

^h Unpackaged breads include various loose breads, baguettes, rolls (seed, multigrain, diamond, pumpkin, cheese/onion etc), baps, ciabatta, Panini, whole unsliced loafs etc. Many of these breads are bought in a prepared raw state and baked in-store. Many symbol group retailers and supermarket chains now sell these bread products through in-store bakeries

ⁱ Unless otherwise stated

^j Includes 68 soda bread samples and 57 bread roll samples.

Links to Further Information on Salt Reduction in Bread:

[Managing Salt Reduction in Bread](#)

[Achieving Salt Reduction in Bread](#)

[Salt in Bread: Technical, Taste and other Parameters for Healthy Eating](#)

[Reducing Salt in Bread: A Quick Guide for Craft Bakers](#)

Table 7 Breakfast Cereals (Sodium in mg/100g)

Category	Mean Sodium Per Year of Survey (Standard Deviation) [Range]				t-test ($\alpha = 0.05$)	% Sodium Change
	2003	2007	2011 ^h	2015	2003 to 2015	
Rice Based Cereals ^a	555 (168) [316 - 769]	583 (141) [390 - 800]	307 (70) [220 - 490]	287 (95) [120 - 480]	< 0.05	▼ 48
Bran Based Cereals ^b	544 (174) [194 - 817]	430 (128) [220 - 600]	336 (134) [140 - 620]	334 (67) [200 - 430]	< 0.05	▼ 39
Cornflake Based Cereals ^c	761 (132) [535 - 911]	551 (101) [400 - 750]	309 (117) [140 - 570]	279 (76) [120 - 430]	< 0.05	▼ 63
Biscuit Based Cereals ^d	311 (103) [238 - 536]	268 (48) [180 - 340]	218 (39) [120 - 260]	240 (52) [110 - 290]	NSD	NSD
Multigrain Cereals ^e	534 (170) [198 - 744]	348 (137) [120 - 650]	277 (104) [120 - 500]	333 (77) [210 - 490]	<0.05	▼ 38
Muesli ^f	261 (81) [171 - 367]	162 (60) [120 - 260]	138 (20) [100 - 160]	NT	< 0.05	▼ 47 ⁱ
All Other Cereal Products ^g (No Added Salt/Low Salt)	21 (30) [<10 - 118]	32 (27) [<10 - 110]	32 (31) [<10 - 110]	NT	0.05	▲ 51 ⁱ
Total Samples	88	119	330	150	Overall Total = 687	

^a Includes products which are rice based and/or have "Rice" in their main product description. For the year 2003 this category also includes one corn based product. This category may also include some adult/health cereals which are based on rice

^b Bran is the outer layer of cereals including corn (maize), rice, oats, wheat, barley etc. and is typically produced as a by-product of milling This category includes products which have "Bran" in their main description and other related cereals which contain bran such as Fruit & Fibre cereals **2003 (n = 3/9); 2007 (n = 7/20); 2011 (n=15/39)** representing 5 individual products

^c Includes products which have "Cornflake" or "Flake" in their main description and includes varieties such as Frosted, Honey & Nut etc. Excludes those cornflake based products which have "Bran" in their description

^d Includes products which are predominately wheat/oat based and biscuit shaped

^e Includes products which have more than one cereal grain in their ingredient listing. This category may also include some cereal which contains other ingredients such as nuts and fruit

^f Includes products which have "Muesli" in their product description and includes varieties with added fruit, nuts and no-added sugar/sweetener

^g Includes all cereal products which have no added salt *i.e. results obtained reflect natural content and variation* or levels of salt below 120mg/100g = Low Sodium/Salt [Regulation 1924/2006](#). This category includes samples of porridge which are also described as Wheatbran, Oatbran, Oatflakes, Oatlets, Oatmeal, Oat Cereal, Pinhead etc. Other products in this category include various muesli, crunch cluster, wheat puff, Wholewheat, rice and bran based cereals

^h The majority of products surveyed in 2011 were sampled three times with three distinct batches and/or best-before dates to provide more representative sampling of products. Total number of samples taken in this survey number was 330. 14/330 of the samples were porridge products. Of the remaining 316 samples 98 products were sampled 3 or more times ($3 \times 98 = 294$ samples); 9 products were sampled 2 times ($9 \times 2 = 18$ samples) and 2 products were sampled just once ($2 \times 1 = 2$). Therefore a total of 109 individual products were sampled in the 2011 survey excluding porridge products

ⁱ Percentage sodium reduction between 2003 and 2011.

Table 8 Spreadable Fats (Sodium in mg/100g)

Category ^a	Mean Sodium Per Year of Survey (Standard Deviation) [Range]			t-test ($\alpha = 0.05$)	% Sodium Change
	2007	2011	2015	2007 to 2015	
Butter ^{b-c}	631 (234) [490 - 1460]	518 (124) [240 - 660]	592 (117) [250 - 770]	NSD	NSD
Half-Fat Butter ^d	560 (104) [500 - 680]	437 (25) [410 - 460]	NT	NSD ^p	NSD ^p
All Butters ^{b-d}	619 (217) [490 - 1460]	504 (117) [240 - 660]	592 (117) [250 - 770]	NSD	NSD
Margarine ^e (Fat Content >80% but <90%) ^f	313 (191) [100 - 470]	560 (138) [430 - 760]	NT	NSD ^p	NSD ^p
Fat Spread ^e (Fat Content >62% but <80%) ^g	710 (305) [460 - 1150]	438 (83) [350 - 540]	505 (115) [300 - 760]	NSD	NSD
Fat Spread ^e (Fat Content >41% but <60%) ^h	532 (112) [270 - 690]	476 (107) [260 - 710]	498 (104) [300 - 670]	NSD	NSD
Fat Spread ^e (Fat Content <39%) ⁱ	511 (164) [10 - 720]	462 (59) [380 - 580]	523 (95) [410 - 700]	NSD	NSD
All Fat Spreads (Excluding Margarine) ^{f-i}	541 (166) [10 - 1150]	467 (92) [260 - 710]	505 (105) [300 - 760]	NSD	NSD
Blend ^j (Fat Content >80% but <90%) ^k	390 (28) [370 - 410]	393 (107) [270 - 460]	NT	NSD ^p	NSD ^p
Blended Spread ^j (Fat Content >62% but <80%) ^l	649 (56) [570 - 720]	615 (24) [590 - 640]	460 (36) [430 - 500]	< 0.05	▼ 29
Blended Spread ^j (Fat Content >41% but <60%) ^m	530 (113) [450 - 610]	530 (75) [450 - 600]	410 (34) [370 - 450]	NSD	NSD
All Blends & Blended Spreads ^{j-m}	586 (117) [370 - 720]	538 (111) [270 - 640]	427 (41) [370 - 500]	<0.05	▼ 27
Total Samples	72	90 ⁿ	90 ^o	Overall Total = 252	

- ^a Categories are based on sale descriptions outlined in Annex XV of Council Regulation (EC) No 1234/2007 establishing a common organisation of agricultural markets and on specific provisions for certain agricultural products (Single CMO Regulation). [Link to Spreadable Fats Legislation](#)
- ^b Products with a milk-fat content of not less than 80% but less than 90%, a maximum water content of 16% and a maximum dry non-fat milk-material content of 2%
- ^c Includes one flavoured butter (Garlic & Herb) and excludes 3 unsalted butters for 2007 results
- ^d Includes one product described as a low-fat butter with a 40% fat content. The terms 'low-fat' or 'light' may be used for products referred to in the Annex XV of Council Regulation (EC) No 1234/2007 with a fat content of 41% or less. The term reduced-fat and the terms low-fat or light may, however, replace respectively the terms three quarter-fat or half-fat used in the Annex
- ^e Products in the form of a solid, malleable emulsion, principally of the water-in-oil type, derived from solid and/or liquid vegetable and/or animal fats suitable for human consumption, with a milk-fat content of not more than 3% or the fat content
- ^f Products obtained from vegetable and/or animal fats with a fat content of not less than 80% but less than 90%
- ^g Products obtained from vegetable and/or animal fats with a fat content of more than 62% but less than 80%
- ^h Products obtained from vegetable and/or animal fats with a fat content of more than 41% but less than 60%
- ⁱ Products obtained from vegetable and/or animal fats with a fat content of less than 39%
- ^j Products in the form of a solid, malleable emulsion principally of the water-in-oil type, derived from solid and/or liquid vegetable and/or animals fats suitable for human consumption, with a milk-fat content of between 10 % and 80 % of the fat content
- ^k Products obtained from a mixture of vegetable and/or animal fats with a fat content of not less than 80% but less than 90%
- ^l Products obtained from a mixture of vegetable and/or animal fats with more than 62% but less than 80%
- ^m Products obtained from a mixture of vegetable and/or animal fats with a fat content of more than 41% but less than 60%
- ⁿ 2011 samples comprise 90 individual samples representing 31 individual products
- ^o Includes 3 samples of beef dripping but not included in values presented
- ^p 2007 to 2011 values.

Link to Guidance on Spreadable Fats:

[Guidance Note No. 30: The Use of the Term 'Butter' in the Labelling and Advertising of Fat Spreads](#)

Table 9 Natural Cheese ^a (Sodium in mg/100g)

Category	Mean Sodium Per Year of Survey (Standard Deviation) [Range]			t-test ($\alpha = 0.05$)	% Sodium Change
	2009	2012	2018	2009 to 2018	
Regular ^b	731 (236) [520 - 1360]	641 (61) [490 - 780]	633 (62) [502 - 739]	NSD	NSD
Mature ^c	667 (64) [560 - 770]	651 (42) [570 - 730]	625 (51) [507 - 734]	< 0.05	▼ 4
Reduced Fat ^d	756 (287) [560 - 1270]	637 (95) [530 - 710]	652 (69) [529 - 827]	NSD	NSD
All Cheese	709 (196) [520 - 1360]	644 (56) [490 - 780]	632 (58) [502 - 827]	< 0.05	▼ 11
Total Samples	34	56	93 ^e	Overall Total = 183	

^a Samples are predominately cheddar or cheddar based cheese products which are the most commonly consumed cheeses in Ireland

^b Regular includes both white and red/coloured cheddars which are labelled as smooth, creamy, medium or mild

^c Mature includes both white and red/coloured cheddars which are mature, extra mature or vintage

^d Reduced fat includes both white and red/coloured cheddars or cheddar based cheese products which are labelled light, reduced, half-fat etc.

^e Total samples comprise Regular = 33; Mature = 45 and Reduced Fat = 15

Table 10 Processed Cheeses (*Sodium in mg/100g*)

Category	Mean Sodium Per Year of Survey (Standard Deviation) [Range]		t-test ($\alpha = 0.05$)	% Sodium Change
	2009	2014 ^e	2009 to 2014	
Blocks, Strips & Slices ^{a-b}	1095 (330) [580 - 1610]	867 (261) [410 - 14710]	<0.05	▼ 21
Reduced Fat: Blocks, Strips & Slices ^{a-b}	1298 (219) [1130 - 1590]	836 (224) [590 - 1430]	< 0.05	▼ 36
Spreads ^c	626 (392) [190 - 1120]	670 (252) [130 - 1000]	NSD	NSD
Reduced Fat: Spreads ^d	613 (310) [260 - 1080]	376 (238) [170 - 860]	0.05	▼ 39
<i>All Processed Cheese</i>	893 (418) [190 - 1610]	651 (315) [130 - 1470]	< 0.05	▼ 27
Total Samples	36	173	Overall Total = 209	

^a Includes white and red/coloured cheese slices individually wrapped or not

^b Includes white and red/coloured cheese slices which are light, reduced or half-fat, individually wrapped or not

^c Includes white and red/coloured cheese spreads which individually portioned or not and cheese spreads with added ingredients such as herbs, vegetables and meats and spreads used as cooking sauces

^d Includes white and red/coloured cheese spreads which are light, reduced or half-fat, individually wrapped or not and reduced fat cheese spreads with added ingredients such as herbs, vegetables and meats and spreads used as cooking sauces

^e Taken between October and December 2014, comprising 82 branded and 91 private label samples.

Table 11 Condiments (*Sodium in mg/100g*)

Category ^a	Mean Sodium Per Year of Survey (Standard Deviation) [Range]		t-test ($\alpha = 0.05$)	% Sodium Change
	2017 ^f		
Ketchup ^b	681 (294) [100 - 1500]		NA	NA
Salad Cream ^c	581 (78) [450 - 790]		NA	NA
Mayonnaise ^d	544 (125) [280 - 770]		NA	NA
Brown Sauce ^e	444 (325) [220 - 1340]		NA	NA
Total Samples	157			

^a All products sampled and analysed in triplicate [exception one branded tomato ketchup product only available as a single sample]

^b Six branded products produced by four manufacturers and twelve private label products from six retailers.

^c Two branded products produced by one manufacturer and seven private label products from four retailers

^d Four branded products produced by two manufacturers and twelve private label products from six retailers

^e Four branded products produced by three manufacturers and six private label products from five retailers

^f Samples taken in August 2017.

Data on Potassium:¹

¹ In 2012, the WHO recommended an increase in potassium intake from food to reduce blood pressure and the associated risk of cardiovascular disease and stroke in adults. The WHO has suggested a potassium intake of at least 3.5g potassium per day *i.e.* 90 *mmol* or 3510 *mg* for adults ²¹.

Table 12 Soup Products (*Potassium in mg/100g*)

Category ^a	Mean Potassium Per Year of Survey (Standard Deviation) [Range]				t-test ($\alpha = 0.05$)	% Potassium Change
	2005	2010	2013/14	2017 ^h	2005 to 2017 ⁱ	
Fresh Soup ^b	114 (47) [45-213]	143 (43) [60-250]	134 ^f (42) [60-190]	NT	NSD	NSD
Ambient Soup ^c	106 (49) [44-174]	166 (94) [40-350]	NT	135 (51) [60 - 260]	NSD	NSD
Canned Soup ^d	99 (69) [25-352]	106 (55) [50-260]	118 ^f (77) [30-270]	119 (61) [40 - 240]	NSD	NSD
Dried Soup ^e	579 (225) [152-1152]	762 (301) [180-1380]	732 ^g (394) [180 - 2315]	NT	< 0.05 (2005 v 2013/14)	26 ▲ (2005 v 2013/14)
Total Samples	126	114	145	44	Overall Total = 429 ⁱ	

^a Unless otherwise indicated all samples were analysed as sold. Varieties of soup sampled within each category: Mushroom, Vegetable, Tomato and Chicken.

^b Chilled soup

^c Includes ambient soups packed in both flexible retort packs and plastic pots

^d Some canned/tinned soups are condensed and diluted before cooking/consumption (dilution varies by manufacturer)

^e Includes both dried packet, dried instant and concentrated liquid varieties. Dried and concentrated soups are diluted before cooking/consumption (dilution varies by manufacturer).

^f Samples taken in May and October 2013

^g Samples taken from April to May 2014.

^h Samples taken in August 2017

ⁱ Except were indicated.

Table 13 Ready Meals (*Potassium in mg/100g*)

Category ^a	Mean Potassium Per Year of Survey (Standard Deviation) [Range]			t-test ($\alpha = 0.05$)	% Potassium Change
	2004	2009	2014	2004 to 2014	
Oriental Dishes ^b	131 (35) [87 - 203]	193 (17) [100 - 150]	122 (19) [80 - 180]	NSD	NSD
Pasta Dishes ^c	207 (54) [158 - 352]	188 (55) [90 - 280]	203 (40) [150 - 280]	NSD	NSD
Curry Dishes ^d	168 (68) [83 - 309]	165 (59) [100 - 280]	190 (67) [80 - 350]	NSD	NSD
Pizza ^e	NT	NT	185 (50) [130 - 460]	NA	NA
Meat Pies ^f	167 (21) [136 - 185]	115 (38) [60 - 160]	NT	< 0.05 (2004 v 2009)	31 ▼ (2004 v 2009)
Quiche ^g	200 (39) [135 - 241]	234 (64) [120 - 380]	NT	NSD	NSD
Total Samples	51	51	181	Overall Total = 283	

^a May include chilled and/or frozen samples

^b May include Chicken, Beef or Pork Sweet & Sour, Black Bean, Chow Mein, Noodle Dishes and others

^c May include Lasagne (Beef, Pork or Vegetarian), Cannelloni and others

^d May include Indian, Thai and Chinese Chicken, Beef or Pork curries such as Tikka, Korma, Bhuna, Balti, Masala, Tandoori, Green & Red Curry and others

^e **New Category for 2014:** samples include only Cheese and Margarita varieties

^f May include Shepherds, Cottage, Steak & Kidney and Steak and one sample of beef stew for 2004 (**Discontinued Sampling Category**)

^g Typically Quiche Lorraine (**Discontinued Sampling Category**)

Table 14 Cooking Sauces (Potassium in mg/100g)

Category ^a	Mean Potassium Per Year of Survey (Standard Deviation) [Range]				t-test ($\alpha = 0.05$)	% Potassium Change
	2004	2009	2012	2016	2004 to 2016 ^e	
Carbonara ^b	64 (26) [38 - 106]	77 (43) [30 - 150]	NT	45 (20) [20 - 80]	NSD	NSD
Bolognese ^c	353 (69) [236 - 460]	315 (70) [160 - 420]	282 (56) [190 - 400]	349 (51) [280 - 450]	NSD	NSD
Curry ^d	186 (41) [118 - 259]	180 (48) [110 - 320]	211 (103) [120 - 550]	171 (69) [80 - 340]	NSD	NSD
Sweet & Sour	109 (37) [56 - 204]	99 (18) [70 - 140]	103 (24) [60 - 140]	115 (25) [90 - 180]	NSD	NSD
Black Bean	156 (124) [64 - 391]	104 (29) [50 - 140]	122 (21) [100 - 150]	NT	NSD ^g	NSD ^g
Total Samples	52	71	48	88 ^f	Overall Total = 259	

^a Includes jarred, pouch and other forms of ambient packaged samples. No fresh cooking sauces were sampled. Some products sampled include potassium chloride as an ingredient

^b Cream based pasta sauces

^c Tomato based pasta sauces and included in 2016, red pesto sauces

^d Includes different varieties of curry sauce such as Tikka, Korma, Bhuna, Balti, Masala and Tandoori

^e Unless otherwise stated

^f Omitted Black Bean (n=2); Chilli Con Carne (n=3); Chow Mein (n=2); Hoi Sin (n=1); Thai Curry (n=2). All omitted results are available on request to the FSAI

^g Percentage sodium reduction between 2004 and 2012

Table 15 Snacks (Potassium in mg/100g)

Category	Mean Potassium Per Year of Survey (Standard Deviation) [Range]					t-test ($\alpha = 0.05$)	% Potassium Change
	2006	2008	2011	2013	2016	2006 to 2016 ^e	
Corn Chips	205 (41) [160 - 280]	235 (58) [160 - 370]	220 (39) [180 - 270]	NT	NT	NSD (2006 v 2011)	NSD (2006 v 2011)
Extruded Snacks ^a	363 (298) [0 - 1030]	377 (227) [110 - 890]	304 (83) [190 - 460]	371 (180) [130 - 740]	312 (124) [180 - 580]	NSD	NSD
Luxury Crisps ^b	777 (153) [640 - 1090]	975 (246) [660 - 1340]	1208 (278) [860 - 1750]	NT	NT	< 0.05 (2006 v 2011)	36▲ (2006 v 2011)
Pelleted Snacks ^c	368 (273) [90 - 1030]	331 (189) [110 - 670]	858 (62) [800 - 940]	857 (25) [830 - 880]	960 (42) [930 - 990]	< 0.05	160▲
Popcorn	321 (347) [90 - 1160]	172 (64) [90 - 250]	230 (18) [210 - 250]	NT	NT	NSD (2006 v 2011)	NSD (2006 v 2011)
Potato Crisps ^{b, d}	1072 (237) [660 - 1420]	1116 (224) [370 - 1450]	1082 (283) [600 - 1690]	1269 (260) [770 - 1870]	1139 (219) [630 - 1440]	NSD	NSD
Salt & Vinegar Products	1030 (568) [90 - 2220]	872 (311) [400 - 1300]	994 (363) [170 - 1640]	1254 (296) [620 - 1830]	1139 (230) [620 - 1490]	NSD	NSD
Total Samples	136	97	137	102	59	Overall Total = 531	

^a Food extrusion is a process in which a food material is forced to flow, under one or more varieties of conditions of mixing, heating and shear, through a die which is designed to form and/or puff-dry the ingredients **e.g. onion rings** can be described as puffed snacks also. There are many different raw materials which can be used for extruded snack production including potato, rice, maize, wheat, corn etc.

^b Potato (of various varieties) which are sliced (flat, crinkle cut etc), lightly fried in vegetable oil and then sprinkled with flavouring

^c There are many different raw materials which can be used for pellet production such as; potato, rice, maize, wheat, corn etc. The pellets are divided into two basic categories, those made from grain (rice, maize, wheat, corn) or those made from potato. The latter being the only one to give the authentic potato taste to the finished product. Pelletised snacks are produced when the raw material is extruded into a recognisable shape, this can be done using a process known as direct expansion or alternatively using a process known as indirect expansion. The direct expanded pellets are produced in a one-step extruder and are ready for consumption following the extrusion process. The indirect expanded pellets are extruded and then generally sold on as a semi-manufactured product to companies who finish the process by frying them in hot oil then dosing them with flavouring or seasoning before packaging.

^d The majority of potato crisps sampled are cheese and onion flavour or variations of that flavour. Some brands of crisps sampled contained Potassium Chloride as an ingredient

^e Unless otherwise stated.

Table 16 Processed Meats (*Potassium in mg/100g*)

Category ^a	Mean Potassium Per Year of Survey (Standard Deviation) [Range]					t-test ($\alpha = 0.05$)	% Potassium Change
	2004	2006	2009	2012	2015	2004 to 2015	
Sausages ^b	161 (51) [65 - 292]	162 (37) [100 - 280]	139 (38) [90 - 260]	144 (36) [80 - 230]	158 (41) [100 - 300]	NSD	NSD
Rashers ^c	281 (28) [237 - 318]	302 (43) [230 - 430]	281 (34) [190 - 330]	302 (46) [210 - 390]	318 (58) [250 - 510]	< 0.05	13▲
Pudding ^d	138 (41) [57 - 181]	155 (33) [90 - 210]	166 (33) [90 - 240]	186 (30) [140 - 240]	186 (36) [120 - 260]	< 0.05	35▲
Cooked Ham ^e	334 (124) [216 - 796]	310 (49) [200 - 420]	389 (81) [270 - 500]	313 (20) [250 - 360]	341 (45) [260 - 480]	NSD	NSD
Total Samples	267^f	194^g	98^h	127	148	Overall Total = 834	

^a Unless otherwise indicated all samples were analysed as sold *i.e.* raw. Potassium maybe present in some cured products as a result of the cure ingredient used *e.g.* Potassium Nitrate

^b Includes both pork and beef sausages

^c Rashers of bacon are cured pork and may come from any part of the pig and maybe smoked or unsmoked *i.e.* green. The majority of samples analysed in the FSAI surveys were back and streaky rashers.

^d Includes both white and black varieties of traditional Irish blood puddings

^e Ham is traditionally the cured product taken from the upper leg and buttock of the pig. However, the majority of samples analysed in the FSAI surveys were pre-sliced reformed or restructured hams including varieties such as crumbed, smoked, honey roast, deli and traditional which were loose, modified atmosphere or vacuum packed.

^f Results for Cooked Sausages (n=12); Bratwurst Sausage (n=1); Cooked Gammon Ham (n=15); Cooked Pudding (n=23); Cooked Burgers (n=9); Vegetarian Burger (n=1); Cooked rashers (n=55); Savoury Steak (n=2); Hot Dogs in Brine (n=1); Canned Cooked Ham (n=3); Raw Burgers (n=71); Gammon Ham (n=4); Cooked Beef (n=2) are omitted from results shown above. However, all omitted results are available on request to the FSAI.

^g Results for Cooked Sausages (n=2); Polish Sausage (n=1); Turkey Sausage (n=1); Cooked Rashers (n=3); Cooked Burgers (n=3); Turkey Rashers (n=2); Raw Burgers (n=7); Gammon Ham (n=8); Cooked Poultry (n=13) Cooked Beef (n=6); Miscellaneous (n=7) are omitted from results shown above. However, all omitted results are available on request to the FSAI.

^h Results for Chicken Sausages (n=1); Cooked Burgers (n=1); Raw Burgers (n=9); Gammon Ham (n=20) are omitted from results shown above. However, all omitted results are available on request to the FSAI.

Table 17 Bread Products (*Potassium in mg/100g*)

Category ^a	Mean Potassium Per Year of Survey (Standard Deviation) [Range]						t-test ($\alpha = 0.05$)	% Potassium Change
	2003	2006	2011	2013	2015	2018	2003 to 2018 ⁱ	
White ^b	141 (24) [120 - 240]	137 (24) [105 - 228]	135 (22) [110 - 210]	119 (7) [100 - 130]	128 (89) [100 - 160]	139 (20) [67 - 190]	NSD	NSD
Brown ^c	251 (43) [159 - 358]	212 (32) [154 - 301]	209 (27) [150 - 250]	186 (29) [140 - 240]	204 (59) [180 - 250]	194 (37) [109 - 241]	< 0.05	23▼
Wholemeal ^d	248 (37) [194 - 330]	221 (25) [185 - 255]	229 (33) [160 - 320]	432 (72) [260 - 570]	242 (70) [220 - 270]	240 (36) [176 - 293]	NSD	NSD
Wholegrain ^e	232 (31) [200 - 296]	196 (41) [141 - 279]	198 (71) [140 - 450]	NT	256 (20) [220 - 290]	202 (40) [160 - 318]	< 0.05	13▼
Speciality ^f	156 (55) [103 - 289]	NT	131 (24) [100 - 180]	NT	196 (29) [140 - 250]	NT	NA	NA
Mixed Flour ^g	NT	NT	167 (24) [140 - 200]	400 (32) [360 - 440]	172 (38) [120 - 220]	162 (21) [138 - 196]	NSD (2011 v 2018)	NSD (2011 v 2018)
Unpackaged ^h	NT	NT	NT	NT	149 (102) [100 - 260]	NT	NA	NA
Total Samples	100	178	186	123	142	97	Overall Total = 826 ^j	

^a 2003 samples taken September 2003; 2006 samples taken November 2005 to January 2006; 2010/11 samples taken July 2010, January 2011 and September 2011. Three samples representing three distinct batches and/or best-before dates were taken for 37 plant (industrial) bakery products in the 2011 survey.

Data on the sodium content of soda breads is available on request for the years 2003, 2006 and 2011 (**n=68**). Soda Breads include all varieties which include “soda” in their description including white and brown varieties. Some products did not include soda on the name/label but soda/sodium bicarbonate was included in ingredients, hence including it in this category

Data on the sodium content of bread rolls is available on request for the years 2003, 2006 and 2011 (**n=57**). Rolls include white and brown varieties of products such as Burger Buns, Baps, Baguettes, and Hot Dog Rolls etc.

^b White Breads include all varieties which include “**white**” in their main description such as Batch, Scotch Batch, Loaf, Barrell, Turnover, Bloomer, Pan, Chleb Malopolski, Kings Bread, Crusty and Cob, excluding soda breads

^c Brown Breads include all varieties which include “**brown**” in their main description such as Batch, Loaf, Hi-Fibre, Wheatgerm, Wholegrain, Barrell, Multigrain, Crusty and Pan, excluding soda breads

^d Wholemeal Breads include all varieties which include “**wholemeal**” in their description and/or include descriptions such as Stoneground, Hi-Fibre, Wheaten, Wheat, Wholewheat, Granary, excluding soda breads

^e Wholegrain Breads include all varieties which include “**wholegrain**” in their description and/or include descriptions such as Multigrain, Healthy-Grain, Granary Malted, Granary, Cob, Rye, Scotch Batch, Malted, Rustic Grain, Nutty, Stoneground, Hi-Fibre, Kibbled, Wholewheat, Cracked Wheat, Scotch Batch, Multigrain and Paco Granary, excluding soda breads

^f Speciality Breads include Ciabatta, Panini, Pitta Breads, Bagels, Corn Bread, Melba toast, Crumpets, Croissants and Procea

^g Mixed Flour Breads are those varieties which mix white, wholemeal or brown flours together. Products in this category are described as “**Best of Both**”, “**50:50 White**”, “**Two in One**” or “**Goodness of Both**” etc.

^h Unpackaged breads include various loose breads, baguettes, rolls (seed, multigrain, diamond, pumpkin, cheese/onion etc), baps, ciabatta, Panini, whole unsliced loafs etc. Many of these breads are bought in a prepared raw state and baked in-store. Many symbol group retailers and supermarket chains now sell these bread products through in-store bakeries

ⁱ Unless otherwise stated

^j Includes 68 soda bread samples and 57 bread roll samples.

Table 18 Breakfast Cereals (*Potassium in mg/100g*)

Category	Mean Potassium Per Year of Survey (Standard Deviation) [Range]				t-test ($\alpha = 0.05$)	% Potassium Change
	2003	2007	2011 ^h	2015	2003 to 2015	
Rice Based Cereals ^a	182 (73) [57 - 292]	165 (59) [70 - 260]	192 (75) [90 - 370]	185 (68) [90 - 320]	NSD	NSD
Bran Based Cereals ^b	523 (135) [314 - 846]	511 (131) [340 - 860]	503 (110) [370 - 870]	532 (92) [430 - 820]	NSD	NSD
Cornflake Based Cereals ^c	95 (23) [57 - 133]	91 (31) [60 - 170]	152 (104) [60 - 540]	117 (93) [60 - 490]	NSD	NSD
Biscuit Based Cereals ^d	344 (59) [224 - 393]	360 (25) [300 - 390]	385 (41) [320 - 450]	414 (25) [370 - 450]	< 0.05	33▲
Multigrain Cereals ^e	237 (63) [92 - 295]	274 (79) [150 - 380]	307 (108) [100 - 540]	277 (118) [120 - 510]	NSD	NSD
Muesli ^f	346 (101) [256 - 522]	488 (35) [450 - 520]	492 (76) [360 - 560]	NT	< 0.05	42▲ ⁱ
All Other Cereal Products ^g (No Added Salt/Low Salt)	485 (212) [<10 - 1121]	454 (197) [<10 - 1100]	396 (158) [<10 - 680]	NT	< 0.05	18▼ ⁱ
Total Samples	88	119	330	150	Overall Total = 687	

^a Includes products which are rice based and/or have "Rice" in their main product description. For the year 2003 this category also includes one corn based product. This category may also include some adult/health cereals which are based on rice.

^b Bran is the outer layer of cereals including corn (maize), rice, oats, wheat, barley etc. and is typically produced as a by-product of milling. This category includes products which have "Bran" in their main description and other related cereals which contain bran such as Fruit & Fibre cereals **2003** ($n = 3/9$); **2007** ($n = 7/20$); **2011** ($n=15/39$) representing 5 individual products.

^c Includes products which have "Cornflake" or "Flake" in their main description and includes varieties such as Frosted, Honey & Nut etc. Excludes those cornflake based products which have "Bran" in their description

^d Includes products which are predominately wheat/oat based and biscuit shaped

^e Includes products which have more than one cereal grain in their ingredient listing. This category may also include some cereal which contains other ingredients such as nuts and fruit.

^f Includes products which have "Muesli" in their product description and includes varieties with added fruit, nuts and no-added sugar/sweetener.

^g Includes all cereal products which have no added salt *i.e. results obtained reflect natural content and variation* or levels of salt below 120mg/100g = Low Sodium/Salt [Regulation 1924/2006](#). This category includes samples of porridge which are also described as Wheatbran, Oatbran, Oatflakes, Oatlets, Oatmeal, Oat Cereal, Pinhead etc. Other products in this category include various muesli, crunch cluster, wheat puff, Wholewheat, rice and bran based cereals.

^h The majority of products surveyed in 2011 were sampled three times with three distinct batches and/or best-before dates to provide more representative sampling of products. Total number of samples taken in this survey number was 330. 14/330 of the samples were porridge products. Of the remaining 316 samples 98 products were sampled 3 or more times ($3*98=294$ samples); 9 products were sampled 2 times ($9*2=18$ samples) and 2 products were sampled just once ($2*1=2$). Therefore a total of 109 individual products were sampled in the 2011 survey excluding porridge products

ⁱ Percentage sodium reduction between 2003 and 2011.

Table 19 Spreadable Fats (*Potassium in mg/100g*)

Category ^a	Mean Potassium Per Year of Survey (Standard Deviation) [Range]			t-test ($\alpha = 0.05$)	% Potassium Change
	2007	2011	2015	2007 to 2015	
Butter ^{b-c}	29 (17) [20 - 70]	50 (74) [20 - 290]	22 (7) [10 - 30]	NSD	NSD
Half-Fat Butter ^d	85 (35) [60 - 110]	30 (0) [30]	NT	NSD ^p	NSD ^p
All Butters ^{b-d}	36 (26) [20 - 110]	47 (68) [20 - 290]	22 (7) [10 - 30]	NSD	NSD
Margarine ^e (Fat Content >80% but <90%) ^f	<10 (<10) [<10]	75 (100) [10 - 270]	NT	NA ^p	NA ^p
Fat Spread ^e (Fat Content >62% but <80%) ^g	45 (19) [20 - 60]	30 (13) [20 - 50]	30 (14) [10 - 50]	NSD	NSD
Fat Spread ^e (Fat Content >41% but <60%) ^h	43 (16) [10 - 60]	34 (15) [10 - 60]	37 (13) [10 - 60]	NSD	NSD
Fat Spread ^e (Fat Content <39%) ⁱ	46 (21) [20 - 90]	52 (24) [20 - 100]	45 (23) [20 - 80]	NSD	NSD
All Fat Spreads (Excluding Margarine) ^{f-i}	45 (19) [10 - 90]	39 (20) [10 - 100]	36 (16) [10 - 80]	0.05	20 ▼
Blend ^j (Fat Content >80% but <90%) ^k	20 (0) [20]	20 (0) [20]	NT	NA ^p	NA ^p
Blended Spread ^j (Fat Content >62% but <80%) ^l	46 (21) [20 - 80]	55 (49) [20 - 150]	17 (6) [10 - 20]	< 0.05	64 ▼
Blended Spread ^j (Fat Content >41% but <60%) ^m	55 (21) [40 - 70]	53 (12) [40 - 60]	33 (16) [20 - 60]	NSD	NSD
All Blends & Blended Spreads ^{j-m}	43 (21) [20 - 80]	46 (37) [20 - 150]	28 (16) [10 - 60]	< 0.05	36 ▼
Total Samples	72	90 ⁿ	90 ^o	Overall Total = 252	

- ^a Categories are based on sale descriptions outlined in Annex XV of Council Regulation (EC) No 1234/2007 establishing a common organisation of agricultural markets and on specific provisions for certain agricultural products (Single CMO Regulation). [Link to Spreadable Fats Legislation](#)
- ^b Products with a milk-fat content of not less than 80% but less than 90%, a maximum water content of 16% and a maximum dry non-fat milk-material content of 2%.
- ^c Includes one flavoured butter (Garlic & Herb) and excludes 3 unsalted butters for 2007 results.
- ^d Includes one product described as a low-fat butter with a 40% fat content. The terms 'low-fat' or 'light' may be used for products referred to in the Annex XV of Council Regulation (EC) No 1234/2007 with a fat content of 41% or less. The term reduced-fat and the terms low-fat or light may, however, replace respectively the terms three quarter-fat or half-fat used in the Annex.
- ^e Products in the form of a solid, malleable emulsion, principally of the water-in-oil type, derived from solid and/or liquid vegetable and/or animal fats suitable for human consumption, with a milk-fat content of not more than 3% or the fat content
- ^f Products obtained from vegetable and/or animal fats with a fat content of not less than 80% but less than 90%
- ^g Products obtained from vegetable and/or animal fats with a fat content of more than 62% but less than 80%
- ^h Products obtained from vegetable and/or animal fats with a fat content of more than 41% but less than 60%
- ⁱ Products obtained from vegetable and/or animal fats with a fat content of less than 39%
- ^j Products in the form of a solid, malleable emulsion principally of the water-in-oil type, derived from solid and/or liquid vegetable and/or animals fats suitable for human consumption, with a milk-fat content of between 10 % and 80 % of the fat content
- ^k Products obtained from a mixture of vegetable and/or animal fats with a fat content of not less than 80% but less than 90%
- ^l Products obtained from a mixture of vegetable and/or animal fats with more than 62% but less than 80%
- ^m Products obtained from a mixture of vegetable and/or animal fats with a fat content of more than 41% but less than 60%
- ⁿ 2011 samples comprise 90 individual samples representing 31 individual products
- ^o Includes 3 samples of beef dripping but not included in values presented
- ^p 2007 to 2011 values.

Link to Guidance on Spreadable Fats:

[Guidance Note No. 30: The Use of the Term 'Butter' in the Labelling and Advertising of Fat Spreads](#)

Table 20 Natural Cheese^a (Potassium in mg/100g)

Category ^a	Mean Potassium Per Year of Survey (Standard Deviation) [Range]			t-test ($\alpha = 0.05$)	% Potassium Change
	2009	2012	2018	2009 to 2018	
Regular ^b	96 (40) [80 - 210]	76 (7) [60 - 90]	80 (7) [71 - 96]	NSD	NSD
Mature ^c	83 (6) [70 - 90]	79 (7) [70 - 90]	80 (5) [70 - 96]	< 0.05	4▼
Reduced Fat ^d	90 (13) [80 - 120]	73 (6) [70 - 80]	83 (6) [74 - 94]	NSD	NSD
All Cheese	89 (23) [70 - 210]	77 (7) [60 - 90]	81 (6) [70-96]	< 0.05	9▼
Total Samples	34	56	93^e	Overall Total = 183	

^a Samples are predominately cheddar or cheddar based cheese products which are the most commonly consumed cheeses in Ireland

^b Regular includes both white and red/coloured cheddars which are labelled as smooth, creamy, medium or mild

^c Mature includes both white and red/coloured cheddars which are mature, extra mature or vintage

^d Reduced fat includes both white and red/coloured cheddars or cheddar based cheese products which are labelled light, reduced, half-fat etc.

^e Total samples comprise Regular = 33; Mature = 45 and Reduced Fat = 15

Table 21 Processed Cheeses (*Potassium in mg/100g*)

Category	Mean Potassium Per Year of Survey (Standard Deviation) [Range]		t-test ($\alpha = 0.05$)	% Sodium Change
	2009	2014 ^e	2009 to 2014	
Blocks, Strips & Slices ^{a-b}	88 (34) [40 - 160]	162 (187) [40 - 790]	< 0.05	84▲
Reduced Fat: Blocks, Strips & Slices ^{a-b}	150 (70) [90 - 240]	255 (221) [80 - 810]	< 0.05	70▲
Spreads ^c	164 (76) [90 - 340]	206 (143) [70 - 630]	NSD	NSD
Reduced Fat: Spreads ^d	193 (37) [130 - 240]	181 (98) [120 - 480]	NSD	NSD
<i>All Processed Cheese</i>	137 (66) [40 - 340]	194 (165) [40 - 810]	< 0.05	41▲
Total Samples	36	173	Overall Total = 209	

^a Includes white and red/coloured cheese slices individually wrapped or not

^b Includes white and red/coloured cheese slices which are light, reduced or half-fat, individually wrapped or not

^c Includes white and red/coloured cheese spreads which individually portioned or not and cheese spreads with added ingredients such as herbs, vegetables and meats and spreads used as cooking sauces

^d Includes white and red/coloured cheese spreads which are light, reduced or half-fat, individually wrapped or not and reduced fat cheese spreads with added ingredients such as herbs, vegetables and meats and spreads used as cooking sauces

^e Taken between October and December 2014, comprising 82 branded and 91 private label samples.

Table 22 Condiments (*Potassium in mg/100g*)

Category ^a	Mean Potassium Per Year of Survey (Standard Deviation) [Range]		t-test ($\alpha = 0.05$)	% Potassium Change
	2017 ^f	2017 to	
Ketchup ^b	386 (135) [240 - 820]			
Salad Cream ^c	27 (8) [20 - 40]			
Mayonnaise ^d	29 (17) [10 - 70]			
Brown Sauce ^e	144 (94) [40 - 290]			
Total Samples	157			

^a All products sampled and analysed in triplicate [exception one branded tomato ketchup product only available as a single sample]

^b Six branded products produced by four manufacturers and twelve private label products from six retailers.

^c Two branded products produced by one manufacturer and seven private label products from four retailers

^d Four branded products produced by two manufacturers and twelve private label products from six retailers

^e Four branded products produced by three manufacturers and six private label products from five retailers

^f Samples taken in August 2017.

References

- 1. He, F.J. and MacGregor, G., (2009).** A Comprehensive Review on Salt and Health and Current Experience of Worldwide Salt Reduction Programmes. *Journal Human Hypertension*, **26**(3), 363-384.
- 2. Appel, L.J., Frohlich, E.D., Hall, J.E., Pearson, T.A., Sacco, R.L., Seals, D.R., Sacks, F.M., Smith, S.C. Jr, Vafiadis, D.K. and Van Horn, L.V. (2011).** The Importance of Population-Wide Sodium Reduction as a Means to Prevent Cardiovascular Disease and Stroke: A Call to Action from the American Heart Association. *Circulation*, **123**, 1138-1143.
- 3. He, F.J., Li, J. and Macgregor, G.A. (2013).** Effect of Longer Term Modest Salt Reduction on Blood Pressure: Cochrane Systematic Review and Meta-Analysis of Randomised Trials. *British Medical Journal*, **346**, f1325.
- 4. Aburto, N.J., Ziolkovska, A., Hooper, L., Elliott, P., Cappuccio, F.P., Meerpohl, J.J. (2013).** Effect of lower sodium intake on health: systematic review and meta-analyses. *British Medical Journal*, **346**, f1326.
- 5. Irish Heart Foundation (2004).** Position Statement: On Salt, Blood Pressure and Heart Disease.
- 6. Irish Heart Foundation (2012).** Cut Down on Salt.
- 7. Food Safety Authority of Ireland (2012).** Written Achievements and Undertakings by the Food Industry: Update Period 2011-2012.
- 8. World Health Organisation (2013).** [Mapping Salt Reduction Initiatives in the WHO European Region.](#)
- 9. Irish Universities Nutrition Alliance, (2011).** National Adult Nutritional Survey – Summary Report on Food and Nutrient intakes, Physical Measurements, Physical Activity Patterns and Food Choice Motives (Ed. Walton, J.).
- 10. World Health Organisation (2013).** [Reducing Salt Intake in the Population.](#)
- 11. European Commission (2012).** [Survey on Members States Implementation of the European Union Salt Reduction Framework.](#)
- 12. Food Safety Authority of Ireland, (2005).** Salt and Health: Review of the Scientific Evidence and Recommendations for Public Policy in Ireland.
- 13. World Health Organisation (2012).** Guideline: Sodium Intake for Adults and Children.
- 14. Perry, I.J., Browne, G., Loughrey, M., Harrington, J., Lutomski, J. & Fitzgerald, A.P. (2010).** Dietary Salt Intake and Related Risk Factors in the Irish Population: A Report for SafeFood.

- 15. Espeland, M.A., Kumanyika, S., Wilson, A.C., Reboussin, D.M., Easter, L., Self, M., Robertson, J., Brown, W.M. & McFarlane, M. (2001).** Statistical Issues in Analyzing 24-Hour Dietary Recall and 24-Hour Urine Collection Data for Sodium and Potassium Intakes. *American Journal Epidemiology*, **153**(10), 996-1006.
- 16. Rennie, K.L., Coward, A. & Jebb, S.A. (2007).** Estimating Under-Reporting of Energy Intake in Dietary Surveys using an Individualised Method. *British Journal Nutrition*, **97**(6), 1169-1176.
- 17. Harrington, J., Perry, I., Lutomski, J., Morgan, K., McGee, H., Shelley, E., Watson, D. & Barry, M. (2008).** SLÁN 2007: Survey of Lifestyle, Attitudes & Nutrition in Ireland - *Dietary Habits of the Irish Population*. Department of Health and Children, Dublin, The Stationery Office.
- 18. Morgan, K., McGee, H., Watson, D., Perry, I., Barry, M., Shelley, E., Harrington, J., Molcho, M., Layte, R., Tully, N., van Lente, E., Ward, M., Lutomski, J., Conroy, R. & Brugha, R. (2008).** SLÁN 2007: Survey of Lifestyle, Attitudes & Nutrition in Ireland - *Main Report*. Department of Health and Children, Dublin, The Stationery Office.
- 19. National Children's Research Centre (2014).** [Cork Children's Lifestyle Study](#).
- 20. Food Safety Authority of Ireland (2013).** Press Release: Salt Content in Processed Food Reduced, but Consumption of Salt Remains High.
- 21. World Health Organisation (2012).** Guideline: Potassium Intake for Adults and Children.
- 22. Food and Drink Industry Ireland (2016).** [The FDI/Crème Global Reformulation Project](#).
- 23. Food Safety Authority of Ireland, (2016).** [Salt and Health: Review of the Scientific Evidence and Recommendations for Public Policy in Ireland \(Revision 1\)](#).