EDUCING SALT: A CHALLENGE FOR THE
FOOD INDUSTRY

An Ingredients Perspective

Dr. Eoin Desmond
R&D Manager
AllinAll Ingredients
Presentation Outline

- Introduction to AllinAll
- Salt Reduction
  - Background
  - Functions of Salt
  - Approaches to Salt reduction
What does AllinAll do?

We design blends that make ingredients work harder to achieve our customers objectives.

To achieve this we maximise the synergies between the ingredients chosen.

Products include:

– Cures & Brines
– Sausage Seasonings
– Burger/Patty Seasonings
– Batters & Breading
– Flavoured Glazes & Marinades
– Functional blends for bakery/dessert applications, ready meals etc. etc.
Salt Reduction
Salt Reduction - Background

1994: Committee on Medical Aspects of Food And Nutrition (COMA) recommended reducing average salt intake from 9g/day to 6g/day

2002: Project Neptune (UK) - an industry-wide sodium reduction programme in the soups and sauces sector.

2003: Scientific Advisory Committee on Nutrition (SACN) launch report on Salt and Health
  - found average intake of salt was 10g/day (8-13g/day)

2004: FSA (UK) campaign on salt commences
  - Salt model
  - 6g salt/day by 2010

2005: FSAI publishes “Salt and Health” document and salt reduction undertakings by Irish industry

2006: FSA publishes revised targets for foodstuffs to be achieved by 2010

2006: American Medical Assoc. (AMA) calls for measures to reduce sodium intake in U.S. diet

2007: CASH issues report on salt reduction

2009: FSA publishes revised targets for foodstuffs to be achieved by 2012
### Legal Requirements for Salt/Sodium Reduction

<table>
<thead>
<tr>
<th>Reduced</th>
<th>Low</th>
<th>Very Low</th>
<th>Sodium/Salt-free</th>
</tr>
</thead>
</table>
| 5% reduction compared to similar product | ≤0.12g of sodium or 0.3g salt per 100g or 100 ml  
In the case of food naturally low in salt/sodium the claim must be made in the form “a low salt/sodium food” | ≤40mg sodium/0.1g salt per 100g or 100 ml | ≤5mg sodium/12.5mg salt per 100g |

[http://www.fsai.ie/uploadedFiles/Cor_Reg1924_2006.pdf](http://www.fsai.ie/uploadedFiles/Cor_Reg1924_2006.pdf)
Reasons for reduced salt

Hypertension and Cardiovascular Disease (CVD)

- CVD is main cause of death in Europe.

- It is estimated that at least one third of premature deaths from CVD in Europe are attributable to unhealthy diets.

- 60,000 premature deaths could be saved by dietary changes.

- The cost of CVD to the EU economy is estimated at €169B per annum (Petersen et al. 2005) while in the US the estimated direct and indirect cost of CVD for 2006 will be $403.1B (Thomas et al. 2006)

Sources: Eurodiet, 2001; European cardiovascular disease statistics (2005); American Heart Association (2006)
Salt Reduction Programme 2003-2012: Meeting Targets and Overcoming Barriers 3rd September 2009

Salt

The government watchdog the Food Standards Agency has announced targets for reducing salt in a range of food products.

The move is designed to cut average daily salt intake in the diet, as too much salt is linked to high blood pressure, which in turn can increase the risk of heart attacks and strokes.

Study: Reducing salt really does lower blood pressure

January 3, 2001
Web posted: 5:21 p.m. EST (2221 GMT)

In this story:

The big "Y" in the argument for salt

Salt levels in bacon twice as high as seawater

by FIONA MacRAE and Robert 'YAPP', Daily Mail
22nd October 2006

It may look more appetizing than seawater. But having a bacon sandwich for breakfast is hardly better for your health.

A study has found that, gram for gram, bacon contains twice as much salt as the Atlantic Ocean.

And the brown sauce that is sometimes served with it contains twice as much salt as seawater.

For Immediate Release: February 24, 2005

Related Links: Salt The Forgotten Killer

Could your sausage kill you?

Most of us know that a full English fry-up can catch us undercooked levels, risking our health.

Now scientists say there is another danger to look out for: rising salt levels.

The Food Standards Agency has discovered that the amount of salt in bacon has increased by 46 per cent.

High salt levels have been linked to high blood pressure, heart disease and stroke.

A study found that, while 24-hour blood pressure was no different in those who ate sausages, it was lower in those who ate bacon.

Related text for adults and children from the age of 11 is justfig.

Advice for younger children differs by age, but it is not recommended to eat more than 1g a day for babies under six months old up to 5g for children of 5-10 years old. Men and women over 50 should consume less than 2.5g.

The FSA stated the amount of salt in uncooked sausages by make, ingredient and quantity.

The brand with the highest level of salt was Richmond.

Getting the salt balance right

The food sector is working hard, but the levels of salt in food cannot be reduced overnight, write MSHP

"Forbidden Killer" Salt Kills 150,000 a Year, Says CSPI Report

CSPI Sues FDA to Force End to 20-Year Delay in Regulating Salt

Too much salt in the diet is boosting Americans’ blood pressure and is prematurely killing roughly 150,000 people each year, according to a new report issued today by the nonprofit Center for Science in the Public Interest (CSPI). Despite the pleas of health experts to cut back, salt consumption has drifted upward over the past 30 years to the point where it now consuming about 4,000 milligrams of sodium per day—recommended amount. CSPI is filing a lawsuit against the Administration (FDA) in federal court to compel the agency as a food additive. Presently, FDA classifies salt as GRAS, recognized as Safe, which means that it is not closely

Reasons to cut the salt

Thursday September 23, 2004

The Guardian

The evidence that the reduction of dietary salt intake by 35% lowers blood pressure and prevents 70,000 strokes and heart attacks nationally was reported in a study published last year (Letters, September 21). This was a meta-analysis of a number of salt studies that looked at salt restriction in people with hypertension and those with normal blood pressure. The beneficial effect on blood pressure was evident in both groups.
Consumer Attitudes

Information usually looked for on Food Labels when buying a product for the first time

Source: Consumer Attitudes to Food Standards. FSA (2006-2008)
# Salt in the Diet

<table>
<thead>
<tr>
<th>Food Sector</th>
<th>Na Contribution (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ireland(^1)</td>
</tr>
<tr>
<td>Cereals and Cereal Products</td>
<td>34.6</td>
</tr>
<tr>
<td>(inc. bread, breakfast cereals,</td>
<td></td>
</tr>
<tr>
<td>biscuits, cakes, pastries)</td>
<td></td>
</tr>
<tr>
<td>Meat &amp; Meat Products</td>
<td>20.5</td>
</tr>
<tr>
<td>Soups &amp; Sauces</td>
<td>7.0</td>
</tr>
<tr>
<td>Processed Vegetables</td>
<td>4.0</td>
</tr>
<tr>
<td>(inc. crisps and snacks)</td>
<td></td>
</tr>
<tr>
<td>Milk and Cream</td>
<td>8.5</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Product</th>
<th>2010 (g or mg per 100g)</th>
<th>Rev. 2010 (g or mg per 100g)</th>
<th>2012 (g or mg per 100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat Products</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacon</td>
<td>3.5g salt/1.4g Na</td>
<td>3.0g salt/1.25g Na</td>
<td>2.88g salt/1.15g Na</td>
</tr>
<tr>
<td>Ham/cured meats</td>
<td>2.5g salt/1g Na</td>
<td>2.0g salt/0.8g Na</td>
<td>1.63g salt/0.65g Na</td>
</tr>
<tr>
<td>Sausages</td>
<td>1.4g salt/550mg Na</td>
<td></td>
<td>1.13g/450mg Na</td>
</tr>
<tr>
<td>Meat pies</td>
<td>1.3-1.5g salt/450-500mg Na</td>
<td>1.1-1.38g salt/400-550mg Na</td>
<td>0.75-1.13g salt/300-450mg Na</td>
</tr>
<tr>
<td>Canned fish</td>
<td>1.0g salt/400mg Na</td>
<td></td>
<td>0.75g salt/300mg Na</td>
</tr>
<tr>
<td>Premixed Bread</td>
<td>1.1g salt/430mg Na</td>
<td>1.0g salt/400mg Na</td>
<td></td>
</tr>
<tr>
<td>Biscuits (unfilled)</td>
<td>1.1g salt/416mg Na</td>
<td></td>
<td>0.68g/270mg Na</td>
</tr>
<tr>
<td>Biscuits (filled)</td>
<td>0.5g salt/205mg Na</td>
<td></td>
<td>0.68g/270mg Na</td>
</tr>
<tr>
<td>Breakfast cereals</td>
<td>0.8g salt/300mg Na</td>
<td></td>
<td>0.68g/270mg Na</td>
</tr>
<tr>
<td>Cheese Products</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Hard-pressed”</td>
<td>1.7g salt/670mg Na</td>
<td></td>
<td>1.8g salt/720mg Na</td>
</tr>
<tr>
<td>“Fresh”</td>
<td>0.8g salt/320mg Na</td>
<td></td>
<td>0.55g/320mg Na</td>
</tr>
<tr>
<td>Baked Beans</td>
<td>0.8g salt/300mg Na</td>
<td></td>
<td>0.63g/250mg Na</td>
</tr>
<tr>
<td>Ready Meals</td>
<td>0.6-1.0g salt/250-400mg Na</td>
<td>0.60g/250mg Na</td>
<td></td>
</tr>
<tr>
<td>Soups (dried &amp; wet)</td>
<td>0.6g salt/250mg Na</td>
<td></td>
<td>0.56g/230mg Na</td>
</tr>
<tr>
<td>Risps</td>
<td>1.5g salt/600mg sodium</td>
<td></td>
<td>1.38g/500mg Na</td>
</tr>
<tr>
<td>Ketchup</td>
<td>2.4g salt/1g Na</td>
<td>2.25g/900mg Na</td>
<td>1.83g/730mg Na</td>
</tr>
<tr>
<td>Soy Sauce</td>
<td>1.5g salt/600mg Na</td>
<td>1.5g/600mg Na</td>
<td></td>
</tr>
<tr>
<td>Mayo</td>
<td>1.5g salt/600mg Na</td>
<td></td>
<td>1.25g/500mg Na</td>
</tr>
<tr>
<td>Pasta Sauces</td>
<td>1.1g salt/430mg Na</td>
<td></td>
<td>0.83g/330mg Na</td>
</tr>
<tr>
<td>Processed Potato Products</td>
<td>0.5g salt/195mg Na</td>
<td>0.49g/195mg Na</td>
<td>0.49g/195mg Na</td>
</tr>
</tbody>
</table>

Source: Food Standards Agency UK
### Nutritional composition (per 100g) of typical meats and meat products

<table>
<thead>
<tr>
<th>Product</th>
<th>Moisture (g)</th>
<th>Protein (g)</th>
<th>Fat (g)</th>
<th>Sodium (mg)</th>
<th>Salt (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Irish/UK Products</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef</td>
<td>71.9</td>
<td>22.5</td>
<td>4.3</td>
<td>63</td>
<td>0.16</td>
</tr>
<tr>
<td>Pork</td>
<td>74.0</td>
<td>21.8</td>
<td>4.0</td>
<td>70</td>
<td>0.18</td>
</tr>
<tr>
<td>Chicken</td>
<td>74.2</td>
<td>24.0</td>
<td>1.1</td>
<td>60</td>
<td>0.15</td>
</tr>
<tr>
<td>Turkey</td>
<td>74.9</td>
<td>24.4</td>
<td>0.8</td>
<td>50</td>
<td>0.13</td>
</tr>
<tr>
<td>Beef burgers</td>
<td>56.1</td>
<td>15-17</td>
<td>21-25</td>
<td>290-400</td>
<td>0.7-1.0</td>
</tr>
<tr>
<td>Sausages</td>
<td>49.4</td>
<td>11-12</td>
<td>25-36</td>
<td>520-1080</td>
<td>1.3-2.5</td>
</tr>
<tr>
<td>Frankfurters</td>
<td>54.2</td>
<td>13-15</td>
<td>15-25</td>
<td>720-920</td>
<td>1.8-2.3</td>
</tr>
<tr>
<td>Smoked Ham</td>
<td>73.2</td>
<td>18-22</td>
<td>3-4</td>
<td>900-1200</td>
<td>1.8-2.6</td>
</tr>
<tr>
<td>Bacon/rashers</td>
<td>63.9</td>
<td>16-17</td>
<td>14-16</td>
<td>1000-1540</td>
<td>2.2-3.8</td>
</tr>
<tr>
<td>Salami</td>
<td>33.7</td>
<td>20.9</td>
<td>39.2</td>
<td>1800</td>
<td>4.6</td>
</tr>
<tr>
<td>Breaded Chicken</td>
<td>53.2</td>
<td>18.0</td>
<td>9-12</td>
<td>200-420</td>
<td>0.5-1.1</td>
</tr>
<tr>
<td>Chicken Nuggets</td>
<td>-</td>
<td>16.0</td>
<td>5.5</td>
<td>600</td>
<td>1.5</td>
</tr>
<tr>
<td>Crispy Chicken</td>
<td>-</td>
<td>17.4</td>
<td>14.5</td>
<td>300</td>
<td>0.8</td>
</tr>
</tbody>
</table>

| **US Products** |              |             |         |             |          |
| Beef patties    | 58.7         | 17.1        | 23.2    | 68          | 0.17     |
| Pork Sausage    | 56.2         | 15.1        | 26.5    | 636         | 1.6      |
| Frankfurters    | 56.0         | 11.5        | 27.6    | 1120        | 2.8      |
| Smoked Ham      | 64.5         | 22.6        | 9.0     | 1210        | 3.0      |
| Corned Beef     | 66.6         | 14.7        | 14.9    | 1217        | 3.1      |
| Canadian-style Bacon | 73.0       | 16.9        | 4.9     | 1016-1400   | 2.5-3.5  |
| Salami          | 34.6         | 21.7        | 37.0    | 1890        | 4.8      |

**Sources:**
- Data also sourced from products retailing in Irish/UK Supermarkets
UK Salt Reduction (CASH) 2007

66% of foods re-surveyed by CASH have reduced their salt content

- 100% reduction in Looney tunes pasta
- 70% reduction in chicken breast dippers
- 50% reduction in white crusty bread
- ~30% reduction in most cornflakes
- 20-32% reduction in sausages
- 21% reduction in cheese strings
- 9% reduction in turkey nuggets

Most bread now contains 0.8g-1.0g of salt per 100
Other reduced salt products

- 0.36% salt
- 0.20% salt
- 0.30% salt
- Trace amount of salt
- 10.67% salt
- 0.5% salt
- 0.6% salt
- 0.6% salt
Technological Functions of Salt

Bread
- Imparts flavour
- Makes wheat gluten more stable and less extensible
- Controls yeast growth and fermentation rate
- Assists in preservation and reduces spoilage

Biscuits
- Gluten development, toughens the gluten and gives a less sticky dough
- Assists in preservation and reduces spoilage

Cheese
- Regulates the activity of starter culture microorganisms
- Modifies enzyme activity and has a direct effect on water content during maturation.
Technological Functions of Salt in Meat Products

Used as a flavouring or flavour enhancer

Responsible for the desired textural properties of processed meats (tenderness and juiciness)

Safety (Preservation)
Technological Functions of Salt in Meat Products

Flavour

- Fat and salt jointly contribute too many of the sensory properties in meat products
- Improves overall flavour balance

- Cooked hams
  - Hams with 1.7% salt were rated as salty as hams with 2-2.3% salt, but saltier than those with 1.1-1.4%
Technological Functions of Salt in Meat Products

Texture

– Main function is the solubilisation of the functional myofibrillar proteins
– Activates the proteins to increase hydration and water binding capacity resulting in a more juicy product
– Increases the negative charges of proteins, thereby causing repulsion between the proteins causing them to swell
Technological Functions of Salt in Meat Products

reservation

– Reducing salt concentrations may alter spoilage patterns. Bacon produced with 1% salt w/w produced vinegary off odours after 2 week storage at 6 °C compared to 3 weeks for bacon containing 2–3% salt w/w. (Applegate et al. 1987).

– When the salt content of bacon was reduced from 3.5% w/w to 2.3% w/w the shelf–life was reduced from 56 days to 28 days.

Source: Stringer and Pin (2005). Microbial risks associated with salt reduction in certain foods and alternative options for preservation. Institute of Food Research UK.
The effect of reducing salt on pathogen growth in a model food systems

Stringer & Pin (2005). Microbial risks associated with salt reduction in certain foods and alternative options for preservation. Institute of Food Research, Norwich, UK.

Salt Reduction Programme 2003-20012: Meeting Targets and Overcoming Barriers 3rd September 2009
Approaches for Salt Reduction

• Reduce peoples’ expectations of saltiness

• Reduce salt content

• Substitution of salt with other ingredients

• Enhance salt properties
Substitution of salt with other ingredients

Substitution with other ionic salts including calcium chloride, magnesium chloride, magnesium sulphate, glutamic acid, potassium glutamate and potassium chloride.

Substitution of NaCl with KCl can be undertaken without functional loss but metallic and astringent tastes can limit its use.

Resistance to potassium chloride.
Salt Reduction Programme 2003-20012: Meeting Targets and Overcoming Barriers 3rd September 2009
Use of Phosphates

Sodium polyphosphate contains 31.2% Na compared to 39.3% in NaCl and is typically used at 0.5% compared to 2-4% usage rate for salt.

Potassium salts of phosphate are also available and can be equally effective.

Research has shown that the addition of phosphates improves the overall quality in terms of yield and sensory perception of reduced salt meat products.
Effects of Salt Reduction and Phosphate Addition on loss and Sensory Attributes of Frankfurters

Cook Loss (%)

Panel Score

Tenderness

Juiciness

Graph showing the effects of salt reduction and phosphate addition on the cook loss and sensory attributes of frankfurters. The graph includes data for different salt concentrations and the addition of STPP.

Research Data

Cook loss of cooked hams with various salt contents

- 1.1% NaCl
- 1.4% NaCl
- 1.7% NaCl
- 2.0% NaCl
- 2.3% NaCl
- 2.6% NaCl

Source: Ruusunen et al. (2001). Agricultural and Food Science and 10 27-32
Use of flavour enhancers/masking agents

Reduce sodium while maintaining good flavour

Reduce salt levels up to 50%

Enhance overall flavour

Provide a more balanced flavour

Mask undesirable flavour notes
Use of flavour enhancers/masking agents

Yeast extracts

MSG, glutamates & glutamic acid

Nucleotides

- Adenosine 5’-monophosphate (AMP). This works by blocking the bitter taste in the mouth
- Disodium inosinate (E631) or guanylate (E627)

Peptides and Amino Acids (L-lysine)

Hydrolysed Vegetable Protein (HVP)

Lactates

Flavonoids
Salt Substitutes/Replacers

Yeast extracts
- containing peptides, amino acids and nucleotides
- “umami” and “kokumi”
- Mixed with HVP

Mycoscent (derived from mycoprotein)
- Delivers succulent salty, brothy taste
- Source of ribonucleotides that deliver flavour enhancing properties

Pansalt®
- a patented salt replacer high in minerals containing KCl, magnesium sulphate and lysine hydrochloride
Salt Substitutes/Replacers

- Lactates
  - improves water binding
  - improves yield and sliceability
  - Increases shelf-life
  - Potassium lactate with no “off” tastes

Reduced Salt Cooked Ham

Log (cfu/g)

Days Storage

- 2.2% NaCl
- 1.5% NaCl+3% NaLactate
Enhancing salt properties

Perception of salt in the solid form is affected by crystal shape and size.

Flake type salt has been shown to be more functional.

Research has been looking at changing the physical form of salt so that it becomes more taste bioavailable and therefore less can be added.

Many different forms of salt:
- Granulated
- Dendritic
- Flake

Patented process for producing natural sea salt with 45-51% less sodium than ordinary salt.
Enhancing salt properties

Fine flake salt can produce meat batters with superior fat and water binding properties compared with dendritic or vacuum evaporated salts.

Moisture was more tightly bound within the fine flake salt meat batter.

Significantly less cook loss.
Enhancing salt properties

Results from model meat blends

<table>
<thead>
<tr>
<th>Salt Type</th>
<th>pH</th>
<th>Soluble Phase Protein (mg/ml)</th>
<th>Total Cook Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine Flake</td>
<td>6.2</td>
<td>34.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Dendritic</td>
<td>5.9</td>
<td>29.4</td>
<td>4.2</td>
</tr>
<tr>
<td>Vacuum Evaporated</td>
<td>6.0</td>
<td>22.9</td>
<td>7.2</td>
</tr>
</tbody>
</table>
“We can only move at the pace dictated by customers.
A reduced salt product which is left on the shelf or to which customers add salt at the table will not benefit anyone”

UK Food and Drink Federation 2004
Salt Reduction

• No Silver Bullet available
  – each product has to be reformulated as a unique entity and that taking away salt adds cost

• Reduce Salt without:
  ▪ Without compromising taste
  ▪ Without compromising functionality
  ▪ Allowing for cleanest ingredient declarations
RECAP: Reducing Salt

Reduce, Replace, Remove

No Single Technology Solution, need to use ingredient combinations. No one size fits all solution

Salt Reduction

- Reduce salt addition
- Substitution of salt with other ingredients
- Enhance salt properties
Contact Information
Eoin Desmond, R&D Manager
Daniel Hickey, Managing Director

AllinAll Ingredients,
33 Lavery Avenue,
Park West
Dublin 12
Ireland

Tel: +353-1-6263957
Fax: +353-1-6266052
email: e.desmond@allinall.ie

www.allinall.ie
THANK YOU FOR YOUR TIME:
Any questions?