Food safety
Dealing with physical contamination

ALSO INSIDE:

Oats and barley
Reducing glycaemic response

Artificial tongue
Let this do your tasting

Alternative packaging materials
Make plastics old school

Anniversary supplement
Milestone birthdays for three major bakery organisations
Experts in dough technology

In-depth knowledge of dough technology is a key ingredient required for the production of high-quality bakery products. With over 35 years of experience in the bakery industry, Rademaker is expert in this field. This know-how, combined with specific sheeting process expertise, overall production process insights and cost of ownership calculations, are used to develop the very best bakery equipment solutions that will work for you.

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P7 Foreword

FEATURES

P8 Cereal beta-glucan & glycaemic response
Dietary fibre from oats and barley – health claims are now endorsed by EFSA. NOFIMA explores their use in detail

P14 Salt – How much is too much?
Love it or hate it, this likable (essential) rogue is in the spotlight again standing as the accused but is still defending strongly

P20 Taste “measurement”
The future of taste analysis could be in the hands of the new “artificial tongue” device developed at Glasgow university used to distinguish samples of whisky. Applications are for the food industry abound and include safety.

FOOD SAFETY

A special double feature on safety and foreign object contamination:

P22 Foreign bodies in food
Time to turn detective – RSSL shows how to use science to identify physical contaminants such as metals, glass etc.

P28 Contamination Scares
Contamination scares can devastate brand reputation at a stroke. “Blockchain” is the new buzz word to limit such damage

SUSTAINABILITY

P32 Sustainability
Are you doing your bit to save the planet and prevent climate change?

CO2 emissions are the hot topic (no pun intended!) Find out what other bakers are doing to reduce their carbon footprint.
Verhoeven Bakery Equipment Family has a long and successful history of tailor-made development, engineering and production for the food industry. In the bakery market the family labels have established a strong position due our innovation and creative turnkey solutions. We sell high end production lines and state-of-the-art machines. Developed and made by a wonderful team of dedicated people. They make us proud. We would love to show you why.
P35 EVENTS

Event previews for two important up and coming shows.

PACKAGING

P42 Single-use plastics
The current challenge to find alternative packaging materials is frantic and relentless for but the transition to eco-heaven is not straight-forward. Campden BRI is on hand to help.

P47 Artificial intelligence and peelable packaging!
A new concept allowing opening forces to be measured and controlled with AI machine learning – we reveal another extraordinary Fraunhofer IVV project!

P50 Anniversary supplement special
It’s time again to pop the champagne, don your party smile and make merry! We feature three glitzy celebrations for three iconic bakery organisations in this issue: The National Bakery School, London still going strong at 125 years, MIWE GmbH at 100 years and FEDIMA a mere youngster at 50 years. Baking Europe goes behind the scenes and explores their relative history, journeys and sometimes rocky paths to success.

INNOVATION PROFILES

P26 Metal fragments in bakery goods
This statement is enough to scare any baker witless! Detection is as essential as flour is to bread making as is having the best equipment to deal with it. Mettler Toledo describes their latest innovation: Gravity Fall metal detection systems.

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Welcome
to the Autumn 2019 issue of Baking Europe!

What do your customers really want? This is the searching question on every baker’s lips – keeping up with trends, allergens, salt, fats and sugar, organic, additive free etc. and still produce a food product that that tastes good at an acceptable price – Oh! and still make a margin! However, just occasionally customers get a little more in their food products than have bargained for – yes, the baker’s nightmare when a foreign object or other contamination in a food product is reported. As horrifying as this situation may be, the investment in prevention measures such as time, money, equipment and constant vigilance can be daunting but which has to be factored in to any manufacturing process. But fear not! There are increasingly effective sophisticated solutions and much research on preventative measures available once again using CT scanning techniques.

*Baking Europe summer 2019 issue also featured CT scanning used to analyse dough structure you may recall. It seems no bakery in the future will be complete without one!

This issue contains a special feature on foreign object identification and innovative ways to combat this (menacing) thorn in the side of your bakery plant.

Having mentioned salt above, a feature from Action on Salt highlights consumer concerns on levels of the sodium compound found in many snack products, whilst on a healthier note, it seems the oats and barley are coming to the rescue again when it comes to lowering cholesterol levels.

Plastic packaging is now hot news globally – increasing reports of major companies addressing this issue is welcome by consumers as is the research on alternative materials and technology. We here at Baking Europe are committed to increasing our reporting of the very latest developments therefore, from the winter 2019 issue onwards, there will be a regular section in every issue.

Other research in this issue includes features on sustainability and CO₂ emissions, an artificial tongue device and a section on more major milestone anniversaries:

MIWE 100 years, FEDIMA 50 years and the UK’s National School of Baking at an impressive 125 years.

From the entire team at Baking Europe…

HAPPY ANNIVERSARY TO ALL!

Graham Pendred
Publisher
Cereal beta-glucan and glycaemic response

How to retain their health benefits during processing

By Anne Rieder, scientist and Simon Simon Ballance, senior scientist NOFIMA (pictured)

BETA-GLUCAN AND EFSA HEALTH CLAIMS
Cereal beta-glucans are a type of dietary fibre primarily found in barley and oats, where they form a part of the cell walls in endosperm and aleurone layer. The amount of beta-glucans in barley and oats depends not
Cereal beta-glucans are a type of dietary fibre primarily found in barley and oats, where they form a part of the cell walls in endosperm and aleurone layer. The amount of beta-glucans in barley and oats depends not only on the variety, but varies with growing conditions and processing (degree of pearling, bran content in flour), typically between 3% and 7%.

The European Food Safety Authority (EFSA) has approved the use of specific health claims for beta-glucans from oats and barley. Products containing 1g beta-glucan per portion are allowed to bear the claim "reduces cholesterol levels" with additional information that a total of 3g beta-glucan per day are required to achieve the claimed effect. To qualify for the claim "reduces post-prandial blood glucose response" a product needs to contain at least 4g beta-glucan per 30g available carbohydrate.

**Figure 1:** Blood glucose response curve after ingestion of 25g available carbohydrate from a glucose drink, white bread or beta-glucan enriched bread (Average and st.dev. of 14 healthy volunteers).

**GLYCAEMIC RESPONSE**
After ingestion of a carbohydrate rich meal, the blood glucose concentration rises. The body reacts with the secretion of insulin, which promotes the uptake of glucose from the blood.
stream into the cells and the blood glucose concentration decreases again. The blood glucose response curves can vary considerably even after consumption of equal amounts of available carbohydrate (Figure 1).

A glucose drink gives a fast and high rise of blood glucose followed by an equally sharp decrease. Compared to glucose and white bread, beta-glucan enriched bread (Here bread containing 4g beta-glucan per 30g available carbohydrate) results in a much lower peak and a broader curve, which is more desirable1.

Lower insulin concentrations are required to control the blood glucose rise after beta-glucan enriched bread. In the end, this may contribute to the prevention of decreased insulin sensitivity, a risk factor for the development of type 2 diabetes. Indeed, beta-glucan has shown potential to improve long-term glycaemic control in some pilot trials, where consumption of beta-glucan rich products for 2-3 months resulted in lowered glycated hemoglobin or increased insulin sensitivity in diabetic or pre-diabetic subjects2,3. The broader shape of the glucose response curve for beta-glucan enriched bread indicates that the carbohydrate from this food is metabolically available for a longer period. This has been linked to increased satiety after consumption of beta-glucan rich meals4,5. However, the currently available scientific documentation on beta-glucan and increased satiety or long-term glycaemic control are not enough to convince EFSA to issue health claims and more work is needed to further understand and document the role of beta-glucan on satiety and long-term glycaemic control.

During baking, enzymes in wheat, barley or rye flour degrade the beta-glucan which is present and reduce its molecular weight. Degradation takes place during mixing, resting and proving. In the oven, beta-glucanases in the dough are inactivated by heat causing degradation of beta-glucan to cease. To minimise beta-glucan MW reduction during bread making, contact time between beta-glucan and flour enzymes should be as short as possible. Figure 2: Beta-glucan molecular weight distribution of breads prepared with 40% barley flour or flakes using a standard or short process.

The approved EFSA health claims for cereal beta-glucan is based on evidence from clinical studies documenting their health benefits. However, unlike the EFSA health claims which are solely based on dose, many of the studies that have formed the basis for the claim approvals have shown that the extent to which cereal beta-glucan effects post prandial glycaemic response or blood cholesterol, does not only depend on their dose, but is highly influenced by their physicochemical properties. Both beta-glucan molecular weight (MW), which is essentially the size of the beta-glucan polymers and solubility have been shown to be very important factors6.

In this experiment, we prepared a standard loaf of bread, where wheat and barley flour were mixed into a dough, fermented and proved together, which resulted in a breakdown of beta-glucan molecules. When barley
and water were incorporated into the fully developed and rested wheat flour dough (Short), degradation was lower and more beta-glucan molecules with high molecular weight could be found in the resulting bread. The use of barley flakes further limited the degradation of beta-glucan by making it physically inaccessible for flour enzymes. However, the resulting breads were not only very dense (consisting of 40% barley flakes), but also showed a reduction in beta-glucan solubility. The preparation of a separate wheat flour dough may also improve the development of the gluten network which can be hindered in the presence of high amounts beta-glucan competing for the available water. The breads pictured in figure 3 are both prepared with 50% (based on flour weight) of a beta-glucan rich milling fraction and contain 4g beta-glucan per 30g available carbohydrate. Bread A is prepared with a standard process (all ingredients are mixed together), while bread B is prepared with two separate doughs that are then mixed together, which does not only improve beta-glucan MW, but results in a better crumb structure and higher volume.

**MECHANISMS OF ACTION AND SOLUBILITY**

Like the reduction in MW, a reduction in beta-glucan solubility also decreases the attenuating effect of beta-glucan rich products on post-prandial blood glucose rise.

A reduction in beta-glucan solubility also decreases the attenuating effect of beta-glucan rich products on post-prandial blood glucose rise.
The beta-glucan in a food product is made partially soluble during digestion contributing to an increased viscosity of the liquid phase. A delayed uptake of glucose and re-absorption of bile salts (resulting in a reduction of cholesterol) due to increased viscosity in the small intestine have been proposed as important mechanisms of action for cereal beta-glucan. However, other aspects like delayed gastric emptying or interaction with the intestinal mucus layer are likely to play a role too.

Regardless of the precise mechanisms, beta-glucan solubility during digestion seems to be important. Unfortunately, it is much more difficult to predict the effect of processing on beta-glucan solubility than on beta-glucan MW. While molecular weight can only decrease during processing, solubility can both increase and decrease. During bread making, beta-glucan solubility usually increases during mixing and decreases during resting. A low beta-glucan solubility in dough before baking generally results in an increased solubility after baking and vice versa. Prolonged storage of beta-glucan enriched breads at room temperature (4-5 days) or in the freezer (1-2 months) has been shown to reduce beta-glucan solubility, probably due to an increased formation of insoluble aggregates (with beta-glucan or other macromolecules in bread).

During wet extraction, however, dramatic degradation can occur if enzyme activities are not controlled.

The EFSA health claim for beta-glucan on the reduction of post-prandial glycaemic response requires the use of 4g beta-glucan per 30g available carbohydrate. This dose is very difficult to achieve in products with a high starch content such as bread.

The use of barley or oat flour alone would not be sufficient as these only contain approximately 5g beta-glucan per 65g starch. Dry fractionation combining milling (pin mill) with sieving (air classification) can be used to enrich the beta-glucan containing cell walls of barley and oat. With this technique beta-glucan contents of 14-30% can be achieved and the starch content of these fractions is also dramatically reduced (10-30% starch). Further concentration of beta-glucan requires the use of wet fractionation. The beta-glucan MW in barley and oat raw material is high (2-3 mill g/mol) and little influenced by dry fractionation. During wet extraction, however, dramatic degradation can occur if enzyme activities are not controlled.

The MW of beta-glucan rich ingredients may therefore vary. MW determination of beta-glucan requires the beta-glucan to be extracted from its matrix. The MW of the extracted beta-glucan can be determined with different analytical systems usually based on size exclusion chromatography. Absolute MW determination requires the use of a light scattering detector, while refractive index and fluorescence (using calcofluor as a beta-glucan specific dye) detection systems need to be calibrated with different MW standards (preferably cereal beta-glucan standards including also high MW standards).

Beta-glucan MW data obtained with different systems or at different laboratories may therefore vary and can only be compared with care considering...
both extraction and analytical procedures that have been used to obtain these values. Other important parameters when choosing a beta-glucan rich ingredient include beta-glucan content, beta-glucan solubility (including method), composition (starch, protein etc.), particle size and technological functionality of the ingredient as well as beta-glucanase activity. Depending on the source and processing, some beta-glucan rich ingredients contain active beta-glucanases, while others don't. Oats are usually kilned before further processing to inactivate lipases, which also reduces the activity of beta-glucanases. Beta-glucan rich ingredients made from barley are more likely to contain beta-glucanase activities.

The choice of ingredients, food formulation and processing all impact the potential of the final product to reduce blood cholesterol and glycaemic response. Successful optimisation of beta-glucan rich products, therefore, requires a truly integrated, knowledge-based approach.

EFSA HEALTH CLAIMS
https://ec.europa.eu/food/safety/labelling_nutrition/claims/register/public/?event=search

References
Action on salt

Consumers advised to pick wisely when they picnic as a new survey exposes dangerously high salty finger foods that could put their health at risk.

- One in four savoury picnic foods are dangerously high in salt
- Some olives contain double the average salt concentration of seawater whilst other products have more salt than a McDonald’s hamburger and fries
- More than one in three of products are higher in salt than their average salt targets
- Almost one in three products have no colour-coded front of pack (FoP) labelling making it hard for consumers to find the healthier option
- Action on Salt is today calling for compulsory front of pack nutritional labelling on all food products and for bold and comprehensive salt reduction targets to be set in 2020

Following the shock findings from
INGREDIENTS
SALT REDUCTION IN PICNIC FOOD

According to Action on Salt, the expert group based at Queen Mary University of London, their new nationwide survey reveals that one in four savoury picnic foods are dangerously high in salt. Some olives contain double the average salt concentration of seawater, and other products have more salt than a McDonald’s hamburger and fries. More than one in three products are higher in salt than their average salt targets. Almost one in three products have no colour-coded front of pack (FoP) labelling, making it hard for consumers to identify the healthier option.

Action on Salt is today calling for compulsory front of pack nutritional labelling on all food products and for bold and comprehensive salt reduction targets to be set in 2020. Following the shock findings from their new nationwide survey, Action on Salt is calling for immediate compulsory front of pack nutritional labelling on all picnic savouries as the food content of a typical picnic basket could contain more than 5g of salt.

The new research, which analysed 555 savoury picnic finger foods available from retailers, highlights the worrying levels of salt in these products whereby one in four are high in salt and would qualify for a red label on front of pack.

Whilst it is not surprising that olives are salty, the salt content of certain products is alarming. Aldi’s specially selected hand stuffed halkidiki olives 150g have 5g of salt per 100g, double the salt concentration of seawater and 1.9g of salt per portion equating to a third of an adult’s daily recommended limit of salt in just 5 olives. Marks & Spencer Stone in Basil & Garlic marinated olive selection 180g contained 3.88g of salt per suggested 100g portion.

Aside from olives, other salt offenders with the highest salt per portion include:

- Ginsters Cornish pasty (272g) with 2.99g of salt per portion, equivalent to 7 portions of salted peanuts
- Aldi eat & go sausages & ketchup with 2.2g per portion, as much salt as 4.5 bags of ready salted crisps
- Fry’s spicy 3 bean pasty (200g), 1.8g per portion which is the amount of salt in a McDonald’s hamburger and fries

In comparison, Scotch eggs, with an average salt content of 0.76g/100g and quiche, with an average salt content of 0.54g/100g, represented the lowest salt categories.

Salt targets were set in 2014 to be met by 2017. In 2018, Public Health England (PHE) released an analysis of the food industry’s progress towards achieving the 2017 targets which revealed many of the targets had not been fully met. Our survey similarly found a staggering half of products were higher in salt than their average salt targets and 17% had more salt than their maximum target. These include:

- Higgidy bold & earthy spinach, feta & roasted tomato quiche 155g – 0.89g/100g (max salt target: 0.68g/100g)
- Waitrose & partners Spanish style chicken kebabs 80g – 0.95g/100g (max salt target: 0.88g/100g)
- Pork Farms original medium pork pie – 1.32g/100g (max salt target: 1g/100g)

Examples of saltiest products

<table>
<thead>
<tr>
<th>Brand</th>
<th>Product Name</th>
<th>Salt content (per 100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldi</td>
<td>Specially selected hand stuffed halkidiki olives 150g</td>
<td>5g</td>
</tr>
<tr>
<td>Asda</td>
<td>Balsamic-glazed mini chorizo 110g</td>
<td>4.2g</td>
</tr>
<tr>
<td>Peperami</td>
<td>Original peperami minis 100g</td>
<td>4.1g</td>
</tr>
<tr>
<td>Marks &amp; Spencer</td>
<td>Stone in basil &amp; garlic marinated olive selection 180g</td>
<td>3.88g</td>
</tr>
<tr>
<td>Waitrose</td>
<td>Queen green olives with cumin &amp; lemon 180g</td>
<td>3.74g</td>
</tr>
</tbody>
</table>

Over the last two years, PHE,
the Department of Health and Social Care (DHSC) have taken little action to encourage the food industry to meet the 2017 targets. However, following the release of the health minister’s green paper last month, now is the opportunity to engage food companies in salt reduction, reiterate the need to meet the 2017 targets and ensure that the proposed 2020 salt reduction targets are strictly monitored.

**VARIATION IN SALT CONTENT**

There was also a significant variation in the salt content of all product categories surveyed showing reformulation is easily achievable.

Action on Salt previously assessed the salt content of meat alternatives in 2018, highlighting

<table>
<thead>
<tr>
<th>Category</th>
<th>Product</th>
<th>Salt per 100g</th>
<th>Product</th>
<th>Salt per 100g</th>
<th>Difference in Salt Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sausage Rolls</td>
<td>Ginsters Large Sausage Roll 130g</td>
<td>1.16g</td>
<td>Aldi Everyday Essentials 8 Sausage Rolls 480g</td>
<td>0.53g</td>
<td>2 times more salt</td>
</tr>
<tr>
<td>Falafel</td>
<td>Gosh! Mediterranean Falafel with Chickpea and Parsley</td>
<td>1.4g</td>
<td>Cauldron Middle Eastern Falafels 200g</td>
<td>0.4g</td>
<td>3.5 times more salt</td>
</tr>
<tr>
<td>Chicken</td>
<td>M&amp;S Just Add Chicken Tikka Mini Fillets 120g</td>
<td>1.33g</td>
<td>Asda Tandoori Chicken Breast Mini Fillets 200g</td>
<td>0.36g</td>
<td>3.5 times more salt</td>
</tr>
</tbody>
</table>
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