Flour improvers
How natural are they?

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Sustainability
Innovate to survive

Eggs
The natural multi-vitamin

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Covid-19 update
Now the Beast
Has Become a Beauty

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The new Era of Bread Cutting Machines

The front surface can be adapted to your shop concept (with customised front decoration and colour).

Touch screen with pre-programmed quick-start buttons for easy operation without a long training period.

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‘Zeitgeist’ forces are disrupting food manufacture and related industry finance. What effects will sustainability and health and wellness have on your business?

P45 Renewable energy – Solar panels
There are more than 10,000 3D printed parts in the latest Rolls-Royce Phantom – Fact. Did you know that ‘printed’ solar panels are now being developed that can power your bakery – and they are much more efficient? Newcastle University (AU) explains the savings and benefits.
Welcome to the Spring 2020 issue of Baking Europe!

The early bumble bees have been chased away by encroaching shadows as the sun now begins to decline in the west, my garden’s daffodils are once again in the shade and my tea is almost finished. During this time, sitting on the steps to my back door, I have been ruminating on the content our first Foreword of 2020, but after an hour of thought it seems clear to me that the scourge and ramifications of COVID-19, will be uppermost in all our minds.

We at Baking Europe, like us all, will never lose sight of the bigger picture, of those either infected or affected, whoever and wherever they may be. We all know, however, that to survive a crisis of this nature when entire countries are under lockdown, that food manufacturers and clockwork logistics, hold the key to keeping people fed and calm during their respective periods of isolation. These organisations have risen to the challenge are doing just that!

An afternoon trip to a food supermarket and was happily surprised to see all the shelves fully packed with food, including the enormous bakery section, which was carrying at least a ‘baker’s dozen’ types of bread (pun intended!), plus a range of sensibly bagged confectionery.

The team here would like to extend our warm thanks and gratitude to everybody involved in the supply chain who has had to meet demand for, e.g.: ingredients, storage and transport, the bakers themselves and everyone involved, many working very long hours, to help bring their baked goods to our shelves and feed the nation. This is a scenario which will no doubt be playing itself out in your country. Thank you, and ‘Chapeau!’ to you all, you are marvels!

Now to the spring issue of Baking Europe and our usual collection of science, applied with, in places, a small helping of levity, e.g.:

Washington State University discusses how we can reduce the use of salt, whilst Campden BRI registers two pieces in this issue, one asking whether fridges are operating at the correct temperatures; and another questioning flour improvers and whether or not they are natural.

Klüber Lubrication’s Anna Breuer is our interviewee in this issue, discussing the use of NSF H1 lubricants.

We are all affected by the sustainability zeitgeist, Newcastle University (AUS) examines exciting developments in solar panels to help reduce your costs. Alix Partners, discusses Private Equity funds and Venture Capital addressing the effects of market disruption created by increasingly health and environmentally conscious customers, and FMCG Gurus opine on the use of fashionable ingredients in baked goods, in Spain. Germany’s venerable TUM (Technical university Munich) provides elucidatory research about the adhesion of dough... a sticky topic and the bane of many bakers!

Finally, we would like to acknowledge those who accepted commissions and who, due to forces majeure, have been unable to do so. We thank you also.

Trevor Brooker
Director
The British used to love consuming eggs until advice was given to curb consumption due to concerns about their cholesterol content. However, this situation was reversed in the 1990s when the Lion Scheme was introduced successfully to control Salmonella and the previous advice was overturned. This shifted the focus to more positive aspects of eggs such as their nutrient content and how they fit within a balanced diet. This article takes a look at the main nutrients within eggs and considers their potential impact on our overall health.

**A GOLDMINE OF PROTEIN, ESSENTIAL AMINO ACIDS AND UNSATURATED FATS**

While the high-quality protein content of eggs is well known, this isn't the case for the vitamins, minerals and fatty acids. Yet, eggs are a very rich source of specific nutrients, e.g. a portion of two eggs provides 100% of the European Nutrient Reference Value (NRV) for vitamin B12 and over 60% of the NRV for vitamin D (although in the UK this would be 32% as the recommended intake has increased to 10 micrograms). In 2012, an updated nutrient composition for UK eggs was published by the UK Department of Health, providing new data for food tables. Since the 1980s, levels of energy, fat, saturated fat and cholesterol have reduced while protein has remained constant due to changes in the size of eggs as well as to poultry feeds. An average medium-sized egg (58g raw) now provides 66kcal, 4.6g fat, 1.3g saturates and 177mg cholesterol (previous figures 78kcal, 5.8g, 1.7g and 202mg respectively).

**A SOURCE OF VITAMINS, MINERALS AND A WHOLE LOT MORE**

Table 1 presents data from this analysis. It can be seen that eggs qualify for several nutritional claims, including a 'source' of claims, including a 'source' of vitamin B12, folate and phosphorus and a 'high/rich source' of vitamin D, riboflavin, vitamin B12, b12, iodine and selenium. EU regulations define a 'source' as at least 15% of the NRV while a 'high/rich source' is at least 30% NRV. Considering that there are few natural sources of vitamin D and eggs contain the more bioavailable form (D3), it is clear that eggs can make an important contribution to overall intake.

**INVESTIGATING EGGS!**

Are they nature's multivitamin?

By Carrie Ruxton PhD RD (pictured), Freelance dietitian
As one of the most complete natural foods available, eggs could indeed be viewed as nature’s multivitamin.
EU Reference Intakes (RI). In contrast, the protein content of eggs is classed as ‘high’ and a portion would supply more than a quarter of the daily RI. Figure 1 breaks down the fat composition of eggs showing that most of the fatty acids are unsaturated, with the largest proportion from the monounsaturated group. When set against NRVs and RIs, a portion of eggs provides more than a fifth of the recommendation for choline, phosphorus and folate, and more than a third of the required riboflavin, biotin, iodine and selenium. The largest contribution is to vitamin D (64% NRV) and vitamin B12 (112% NRV). Thus, as one of the most complete natural foods available, eggs could indeed be viewed as nature’s multivitamin.

SATIETY AND WEIGHT MANAGEMENT

During the past 14 years, nine randomised controlled trials (RCT) examined the potential impact of eggs on satiety and weight management (Table 2). The methodology of studies typically involves a test meal (breakfast or lunch) followed by visual analogue scales to estimate hunger, post-meal fullness (satiety) and desire to eat. Hormone levels are sometimes measured, e.g. ghrelin, a hunger-promoting hormone, and PYY, a satiety-promoting hormone.

In the acute studies (<4 days duration), changes to appetite hormones and hunger and fullness tended to be seen following egg consumption at a meal. However, energy intakes at a subsequent meal were not typically affected, except for the two studies which recruited normal weight men. In longer term studies, the differences in appetite control appeared to be impacting on energy intake as changes were noted to evening snacking in the Leidy et al. (2013) study while there were statistically significant benefits

Table 1: Nutritional composition of whole UK eggs (raw)

<table>
<thead>
<tr>
<th>Nutrition</th>
<th>Per 100g raw</th>
<th>Nutrition claims?</th>
<th>Per medium egg (58g) *</th>
<th>Portion as % Recs #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal)</td>
<td>131</td>
<td></td>
<td>66</td>
<td>7</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>12.6</td>
<td></td>
<td>6.4</td>
<td>26</td>
</tr>
<tr>
<td>Total fat (g)</td>
<td>9</td>
<td></td>
<td>4.6</td>
<td>13</td>
</tr>
<tr>
<td>Saturated fat (g)</td>
<td>2.52</td>
<td></td>
<td>1.3</td>
<td>13</td>
</tr>
<tr>
<td>n3 PUFA (mg)</td>
<td>130</td>
<td></td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Cholesterol (mg)</td>
<td>350</td>
<td></td>
<td>177</td>
<td></td>
</tr>
<tr>
<td>Salt (g)</td>
<td>0.38</td>
<td></td>
<td>0.2</td>
<td>7</td>
</tr>
<tr>
<td>Vitamin A (μg)</td>
<td>126</td>
<td>Source</td>
<td>64</td>
<td>16</td>
</tr>
<tr>
<td>Vitamin D (μg)</td>
<td>3.15</td>
<td>High</td>
<td>1.6</td>
<td>64</td>
</tr>
<tr>
<td>Vitamin E (mg)</td>
<td>1.29</td>
<td></td>
<td>0.7</td>
<td>12</td>
</tr>
<tr>
<td>Vitamin K2 (μg)</td>
<td>7</td>
<td></td>
<td>3.5</td>
<td>9</td>
</tr>
<tr>
<td>Thiamin (mg)</td>
<td>0.08</td>
<td></td>
<td>0.04</td>
<td>7</td>
</tr>
<tr>
<td>Riboflavin (mg)</td>
<td>0.5</td>
<td>High</td>
<td>0.25</td>
<td>36</td>
</tr>
<tr>
<td>Niacin (mg)</td>
<td>0.05</td>
<td></td>
<td>0.03</td>
<td>0.4</td>
</tr>
<tr>
<td>Vitamin B6 (mg)</td>
<td>0.13</td>
<td></td>
<td>0.07</td>
<td>10</td>
</tr>
<tr>
<td>Vitamin B12 (μg)</td>
<td>2.7</td>
<td>High</td>
<td>1.4</td>
<td>112</td>
</tr>
<tr>
<td>Folate (μg)</td>
<td>47</td>
<td>Source</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Biotin (μg)</td>
<td>19.5</td>
<td>High</td>
<td>9.9</td>
<td>40</td>
</tr>
<tr>
<td>Choline (mg)</td>
<td>285</td>
<td></td>
<td>144</td>
<td>72</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>179</td>
<td>Source</td>
<td>91</td>
<td>26</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>46</td>
<td></td>
<td>23</td>
<td>6</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>145</td>
<td></td>
<td>73</td>
<td>7</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>1.72</td>
<td></td>
<td>0.9</td>
<td>13</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>1.12</td>
<td></td>
<td>0.6</td>
<td>12</td>
</tr>
<tr>
<td>Iodine (μg)</td>
<td>50</td>
<td>High</td>
<td>25</td>
<td>33</td>
</tr>
<tr>
<td>Selenium (μg)</td>
<td>23</td>
<td>High</td>
<td>12</td>
<td>44</td>
</tr>
</tbody>
</table>

Key: * weight includes shell but analysis reflects edible part only; # a portion refers to two 58g eggs (edible part only); % Recs = percentage of Reference Intakes for macronutrients and Nutrient Reference Values for micronutrients; except for choline for which an Adequate Intake of 400 mg was set by EFSA in 2016.
to body weight and body fat loss in the large intervention by Vander Wal et al. (2008). In Bayham et al. (2014), a similar pattern was seen in the acute studies where differences in hormone levels and perceived fullness did not translate into energy reduction. This may be because food consumption is largely driven by habit and volume.

It is clear in these studies that consumption of eggs – a high protein food with the complete range of amino acids – is consistently influencing hunger and satiety as well as appetite hormones. In the Marsset-Baglieri et al. (2015) study, it was interesting to note the delay in protein absorption and utilisation following egg consumption compared with the similarly high protein cottage cheese. This suggests that the balance of amino acids in egg protein may be metabolised more slowly and, hence, produce a different profile of hormones. More research is needed to establish why some people eat less when given an egg breakfast or lunch and what might be the ideal intake of eggs for promoting satiety. In the meantime, eggs appear to be a beneficial component of weight management diets.
EVIDENCE OF HEALTH BENEFITS

Whilst research on eggs is amassing across many disparate areas, studies are still skewed towards observational types – basically large uncontrolled surveys – whose findings are clouded by subjects traditionally eating less healthy foods with eggs, such as bacon or fried foods. Such studies have reported statistical associations between high egg consumption and the risk of cardiovascular disease in people with type 2 diabetes. However, this has been challenged by two RCT which examined the impact of a high egg diet on lipid profiles in people with type 2 diabetes. In the first trial, 140 participants were randomised to consume a high egg (>12/week) or a low egg (<2/week) diet for 3 months. No differences were found in lipid profile or glycaemic control at the end of the intervention.

Interestingly, people in the high egg group reported less hunger and greater satiety post-breakfast. In the second trial, 65 participants with type 2 diabetes consumed 14 eggs/week or 100g lean animal protein for 12 weeks. While both groups showed improved glycaemic and lipid profiles, blood pressure and apo-B, results were better for the high egg diet. In contrast to epidemiological research, these studies suggest that eggs have a positive impact on health in people with type 2 diabetes.

Regular readers of Baking Europe will be aware of the various studies that we have published on the diets of older people and it is this population group that has been the focus on several new studies looking at the benefit of eggs. In one observational study of 2497 dementia-free middle-aged men, egg intake was statistically associated with better performance on neuropsychological tests of the frontal lobe and executive functioning. The mechanism may relate to choline and, indeed, this was an ingredient in a medical nutrition product which slowed cognitive decline in patients with early stage Alzheimer’s. Choline is also used in drugs for treating cognitive disturbances in the elderly.

Sarcopenia (muscle loss) is more research is needed to establish why some people eat less when given an egg breakfast or lunch and what might be the ideal intake for promoting satiety.
a common disorder in older people leading to falls and loss of mobility. Evidence suggests that a high protein diet – particularly one containing high biological value protein – can stem the decline in muscle tissue. According to a recent review, eggs can play an important role in boosting the protein content and nutritional value of older people’s diets. Vitamin D is also an important nutrient for preventing falls, as acknowledged by a European health claim, and this is a major nutrient found in eggs.

CONCLUSIONS
Eggs are a high protein, low fat nutritious food that could be considered as ‘nature’s multivitamin’, particularly as they are one of the few natural sources of vitamin D. In contrast to earlier fears, now disproved, that the cholesterol content could adversely affect health, regular consumption of eggs appears to promote satiety which may lead to better weight control. Eggs are also a useful protein source for people with type 2 diabetes. Further research on cognitive function, sarcopenia and glycaemic control is warranted but in the main, this all represents good news for the world’s bakers.

ACKNOWLEDGEMENT
This article was based on research funded by the British Egg Industry Council. For more information, see www.egginfo.co.uk

REFERENCES
2. www.egginfo.co.uk/british-lion-eggs
FLOUR IMPROVERS
Can they be natural?

By Dr Gary Tucker, Technical Development Ambassador, Campden BRI
For thousands of years, bread has been baked using a mixture of different cereal flours and water. Wheat has remained as the main cereal because of its unique blend of proteins that combine during mixing to form the desired gluten network. These create a dough with both viscous and elastic properties to help retain the gases given off during fermentation and proving. Without gluten, dough loses gas and does not lighten in texture during proving, resulting in baked bread which is dense and hard. More recently, bread manufacture has evolved to use a variety of added ingredients of benefit to processing and the final product. This article discusses the use of these minor, but highly functional ingredients in modern plant baking and whether it is possible for these to emanate from a natural or clean label source.

Bread composition has changed little over the years, while bread making techniques have evolved considerably during the same period. Historically, bread was made using a ‘sponge or brew’ system in which flour was mixed with water, and sometimes yeast. The ‘sponge’ or ‘brew’ was then left to ferment for a period of several hours or even days. Considerable beneficial changes to the functionality of wheat flour happened during this period, driven largely by the action of enzymes. After fermentation, other ingredients and additional flour were added and the dough remixed. Simple ingredients such as salt, vinegar and sugar were added to help preserve the finished baked product. Following a time of rest, the dough was divided into pieces, placed in pans, allowed to rise and then baked.

Most of the bread consumed in Europe is now produced by large plant bakeries manufacturing bread and other baked goods on an industrial scale. Machinery, technology and science are put to full use in automated bread making processes designed to deliver consumers what they want – quality, consistency, convenience and price. There will always be debates about industrial bread being different from traditional bread, but the fact remains that around 80% of bread consumed today is plant produced bread. Access to local bakeries enabling fresh bread to be bought daily has diminished as our western lifestyles have changed. Consumers seem to prefer soft bread that lasts at least five days before going mouldy or stale.

There are a number of ways that plant bakeries achieve a lengthy shelf-life using both processing and ingredient solutions. Processing solutions focus on optimising the dough mixing processes so that better use is made of the gluten-forming proteins. The inclusion of air bubbles of various sizes also defines the texture of the bread and gives it its characteristics features. This article covers the ingredient solutions, referred to as improvers, that can be used by bakeries to improve the quality of bread products.
INGREDIENT SOLUTIONS
Bread formulations started life as flour, water, yeast and salt – all of which are natural ingredients – but as bread production became more automated and consumers demanded softness and longer shelf-life, the ingredients list increased in size. Table 1 shows the differences between historic bread recipes and those currently used commercially for a standard white loaf.

This is where ‘improvers’ come in. But what is an improver? Fats/oils, emulsifiers, oxidising or reducing agents, enzymes and preservatives are examples. They are highly functional ingredients which are added to the dough or bread in small quantities i.e. at dosing rates between 20ppm and 3% (on flour weight). Table 2 outlines the approximate dosing levels of these ingredients, again in white bread, and refers to their specific functional attributes. It is common to add these as a blend, known as an improver or concentrate, because this helps with weighing accuracy.

<table>
<thead>
<tr>
<th>Table 1: Recipe for standard white bread, shown in Bakers %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingredient</td>
</tr>
<tr>
<td>----------------------------</td>
</tr>
<tr>
<td>Flour</td>
</tr>
<tr>
<td>Water</td>
</tr>
<tr>
<td>Yeast (block)</td>
</tr>
<tr>
<td>Salt</td>
</tr>
<tr>
<td>Fat / oil</td>
</tr>
<tr>
<td>Commercial Improver (powder or oil-based)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2: Dosing levels of minor ingredients added to white bread, shown in Bakers %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingredient</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>Soya flour</td>
</tr>
<tr>
<td>Vegetable oil</td>
</tr>
<tr>
<td>DATEM (diacetyl tartaric acid esters of mono- and diglycerides)</td>
</tr>
<tr>
<td>SSL (sodium stearoyl lactate)</td>
</tr>
<tr>
<td>GMS (glycerol monostearate)</td>
</tr>
<tr>
<td>Ascorbic acid</td>
</tr>
<tr>
<td>L-cysteine</td>
</tr>
<tr>
<td>Amylases</td>
</tr>
<tr>
<td>Xylanases</td>
</tr>
<tr>
<td>Calcium propionate</td>
</tr>
</tbody>
</table>
The downside of using liquid fat is that it requires an increase in emulsifier level or additional ingredients to boost the lost functionality.
Emulsifiers have also developed over the past 40 years. Their role is to bind to key flour components such as protein, starch and fat. This helps to stabilise the liquid films that surround gas bubbles in dough so that more of the bubbles remain intact during dough processing and into baking. Bread with a fine network of gas bubbles will be softer and appear whiter than with coarse bubbles. Some emulsifiers are specifically used to maintain softness throughout shelf-life, such as glycerol monostearate.

The three main emulsifiers used in the bread industry are DATEM, SSL and GMS. Natural emulsifiers such as lecithin are used to a limited extent because they are less functional and less consistent than their manufactured alternatives. Cake making uses lecithin found naturally in egg. Other natural sources include soya, albeit an allergen, and in sunflower and rapeseed.

**OXIDISING AGENTS**

Another group of bread improvers is that of oxidising agents, such as ascorbic acid (otherwise known as vitamin C). This is a naturally occurring organic compound with antioxidant properties. When flour is mixed with water, the gluten swells to form a continuous network of fine strands and it is this network

Dried fruit extracts, for example from plum and acerola cherry, can be used as alternatives to ascorbic acid.
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