Sustainable protein sources for an ageing population: The Protein for Life Study

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Human Nutrition Research Centre
Newcastle University
Background

- Project funded by the ‘Priming Food Partnerships’ initiative

- Sandpit Event, Bristol September 2016

Aims of the Sandpit:

- To foster partnerships in **pre-competitive research**, across the food chain and **between disciplines**

- To fund **innovative research** of relevance to the food industry and addressing a public health challenge

- To stimulate preliminary research to give support to further research investment
Project Team

Prof Emma Stevenson
Newcastle University

Prof Jeff Brunstrom
University of Bristol

Dr Bernard Corfe
University of Sheffield

Dr Alexandra Johnstone
University of Aberdeen

Dr Mark Green
University of Liverpool

Dr Liz Williams
University of Sheffield
Industry Stakeholders

Campden BRI
food and drink innovation

Mondelez International

Nestlé

Sainsbury’s

pladis

BRADGATE BAKERY

PREMIER FOODS

BBSRC
biodiscovery for the future

MRC Medical Research Council

ESRC Economic & Social Research Council

EPSRC Engineering and Physical Sciences Research Council
The Public Health challenge

One third of adults over 50 years consume less than protein intake recommendations.

Protein slows the decline of muscle mass and strength (sarcopenia) related to ageing.

Top protein sources consumed in the UK only include baked beans as a plant protein.
The Public Health challenge

We are failing to meet the need for food products to support healthy ageing

Protein 4 life is a collaborative grant between academia and the food industry to work towards food solutions
Protein For Life

OUR RESEARCH QUESTION IS: How do we maintain a healthy protein intake in an ageing population?

OUR AIM IS: To develop and to disseminate a set of design rules for formulation of palatable higher-protein foods.
Project Objectives

1. To develop a **multi-disciplinary evidence-base** around protein intake and decision making in older adults

2. To identify **design constraints** for academic and industry partners

3. To use outcomes from Objective 1 to yield a **set of design rules** for higher-protein products

4. To formulate and trial an exemplar product based on the design rules

5. To disseminate our findings to key stakeholders; to develop a more general roadmap to inform product development
Plant Proteins

- The plant protein market is expected to grow at a compound annual growth rate of 8.29% between 2017 and 2021 (Research and Markets 2017)
# Plant Proteins

<table>
<thead>
<tr>
<th>Protein source</th>
<th>Notable characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LEGUME</strong></td>
<td>Of the legumes, only soybean is a complete protein, containing all the essential amino acids. Protein content ranges from 20-40%. Excellent functionality (soy) and potential for many applications (e.g. textured soy proteins). PROS: low allergenicity (exceptions are soybean, peanut and lupine), gluten-free. CONS: anti-nutritional factors, low digestibility and palatability can be a challenge with legumes.</td>
</tr>
<tr>
<td>Soybean</td>
<td>Faba bean, Lentil, Black bean, Mung bean, Kidney bean</td>
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<tr>
<td>Peanut</td>
<td></td>
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<tr>
<td>Pea</td>
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<tr>
<td>Lupine</td>
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<td>Chickpea</td>
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<td>Cowpea</td>
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<tr>
<td><strong>GRAIN</strong></td>
<td>Of the grains, only quinoa is a complete protein, containing all the essential amino acids.</td>
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<tr>
<td>Wheat</td>
<td>Rice, Oat, Sorghum, Millet</td>
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<tr>
<td>Spelt</td>
<td></td>
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<tr>
<td>Quinoa</td>
<td></td>
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<tr>
<td>Amaranth</td>
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<tr>
<td><strong>NUT/SEED</strong></td>
<td>PROS: good application for snack bars, cereals, wide consumer acceptance CON: Allergenicity is an issue for the tree nuts, high energy density may be an issue.</td>
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<tr>
<td>Seeds:</td>
<td></td>
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<tr>
<td>Almond</td>
<td>Sunflower, Pumpkin, Flax, Hemp, Canola</td>
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<tr>
<td>Brazil nut</td>
<td></td>
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<tr>
<td>Walnut</td>
<td></td>
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<tr>
<td>Hazelnut</td>
<td></td>
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<tr>
<td>Cashew</td>
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<tr>
<td><strong>PLANT/FUNGI</strong></td>
<td>Algae have the lowest carbon, water and arable land footprints of any crop. Arthrospira and Chlorella spp. are complete proteins; containing all the essential amino acids. Protein content ranges from 45% (Duckweed) – 70% (Microalgae). PROS: Seaweeds are a good source of Omega 3s, low allergenicity, good palatability.CONS: Limited application of algae (typically fortification/functional foods)</td>
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<tr>
<td><strong>Microalgae:</strong></td>
<td></td>
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<tr>
<td>Potato</td>
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<tr>
<td>Duckweed</td>
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<td>Mankai</td>
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<tr>
<td>Mycoprotein</td>
<td></td>
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<tr>
<td>Seaweed:</td>
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<td>Nori</td>
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<td>Wakame</td>
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<tr>
<td>Kombu</td>
<td></td>
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<tr>
<td>Microalgae:</td>
<td>Spirulina, Arthrospira, Chlorella, Dunaliella</td>
</tr>
<tr>
<td>Dulse</td>
<td></td>
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<tr>
<td>Carrageen</td>
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WP2: Focus groups and interviews on consumer barriers and opportunities for protein consumption
Key Findings

• Protein based ready to eat products
• General resistance towards RTE products - associated with using the gym and building muscle or seen as unnecessary

“These things are for people like bodybuilders and people like that that need it. For the likes of me, I just think its not necessary. It’s like people who go around drinking Red Bull.”
Key Findings

• Views on plant based protein
• Mixed views on plant based proteins – seen as a secondary source of proteins

“High proteins could only be in the animal foods, which are true first class proteins, and then the others were second class, because they don’t have all the amino acids that the body need”.
Key Findings

Where do you prefer to source your protein from?

- Animal based sources
- Plant based sources

Group mean: Animal based sources (90), Plant based sources (40)
45-54: Animal based sources (90), Plant based sources (40)
55-64: Animal based sources (90), Plant based sources (40)
65+: Animal based sources (90), Plant based sources (40)
WP4: Academic and Industry Review
Academic Review

Review
Protein for Life: Review of Optimal Protein Intake, Sustainable Dietary Sources and the Effect on Appetite in Ageing Adults

Marta Lonnie \textsuperscript{1 id}, Emma Hooker \textsuperscript{1}, Jeffrey M. Brunstrom \textsuperscript{2 id}, Bernard M. Corfe \textsuperscript{3,4 id}, Mark A. Green \textsuperscript{5}, Anthony W. Watson \textsuperscript{6 id}, Elizabeth A. Williams \textsuperscript{3 id}, Emma J. Stevenson \textsuperscript{6}, Simon Penson \textsuperscript{7} and Alexandra M. Johnstone \textsuperscript{1,*}

- Sustainability
- Sources
- Amino Acid Composition
- Palatability
Protein For Life – Work Package 4; Industry Report

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WP6: Production of exemplar products and assessment by consumers
Exemplar Product Production

• Led by Campden BRI

• Involvement from all industry partners

• Biscuit product with two different amounts (13% and 22% of total energy) and two different types of protein (animal and plant based protein)
Exemplar Product Production

Control

Source of plant protein: peanut butter, wheat inclusions, soya protein isolate

Source of animal protein: whey protein

Rich in plant protein: peanut butter, wheat inclusions, soya protein isolate

Rich in animal protein: whey protein
Exemplar Product Production

- **Pea protein**: strong legume taste, dry mouth feel. Dough not cohesive

- **Wheat protein**: better taste but bread texture

- **Soya proteins**: less strong flavour but still dry mouth feel

- Inclusion of peanut butter and soy nut butter resulted in a softer texture
Consumer Testing

- Carried out at Aberdeen, Newcastle, Sheffield and Bristol

- 50 participants in each age range (40-54 years, 55-69 years 70+ years) across the sites.

- Participants will complete a sensory panel for each exemplar product in which the product will be assessed alongside a comparable product.

- Participants will be asked to rate a range of sensory responses including palatability, mouth feel, acceptability and expected satiety.
Consumer Testing

Overall acceptability Aberdeen

Overall acceptability Newcastle

Overall acceptability Bristol

Overall acceptability all sites
Summary

• Development or reformulation of products for our ageing population is important

• Important to further understand the consumer group

• Several technical challenges of including higher protein amounts in snack based products whilst also considering taste and texture

• P4L – pump priming first step in developing this area
Any Questions?

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