



Guidance for product innovation and reformulation

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In association with

**sagentia
innovation**

How to use this guide:

This guide aims to comprehensively outline the aspects of product innovation and reformulation that may need to be considered when undertaking reformulation work. However, not all of the considerations are valid for every reformulation and the relevance of the considerations outlined herein is likely to require assessment on a case-to-case basis.

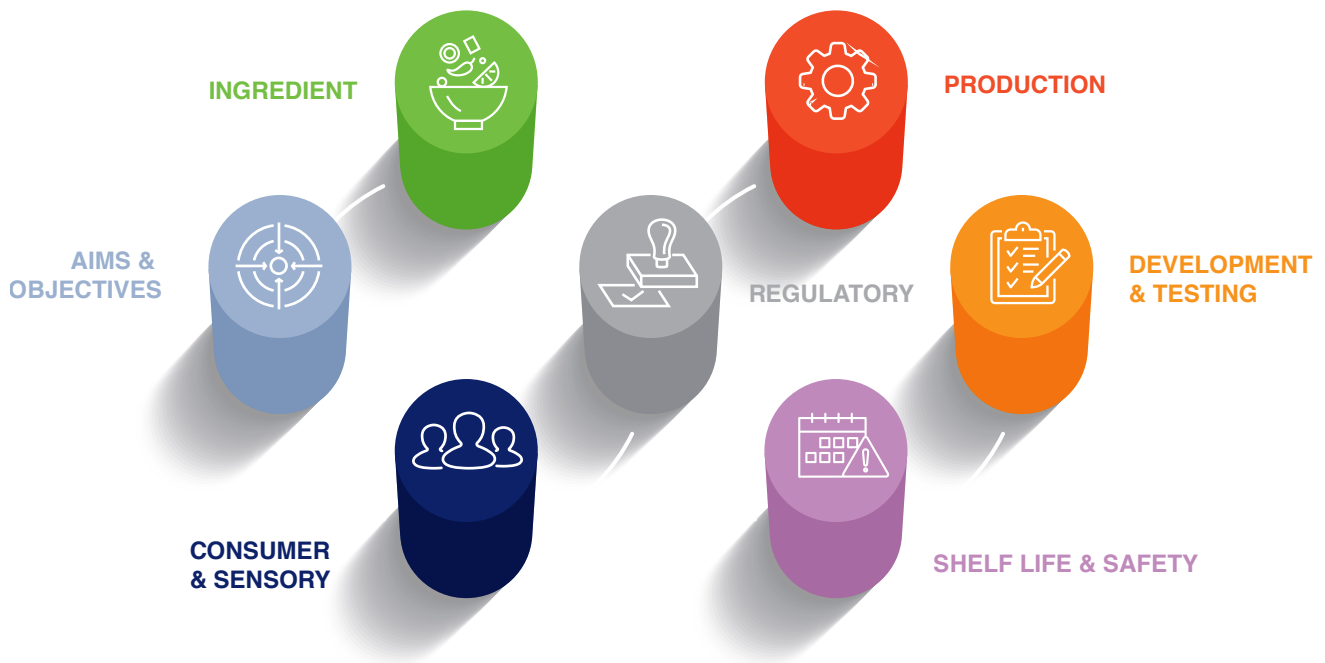
There can be many drivers for reformulating an existing product or developing a new product. An example driver for reformulation can be improving the product composition which may involve reducing, replacing, increasing, or adding ingredients in order to offer better functionality, alter production methods to improve stability, or combinations of both. Other drivers may be:

- **Modifying calorie content of a product**
- **Improving nutritional profile of a product (e.g., through ingredient selection, fortification with micronutrients, increasing fibre, protein, wholegrain, or decreasing salt)**
- **Cost reduction**
- **Supply chain issues**
- **Improving product shelf-life**
- **Enhancing consumer relevant attributes of a product (e.g., texture, melt characteristics)**
- **Responding to regulatory changes**
- **Responding to consumer perceptions and acceptance challenges**
- **Improving sensory profile of a product (e.g., mouthfeel)**
- **Adjusting the portion or serving size**
- **Improving sustainability of a product (e.g., ingredients, production methods, packaging)¹**

Prior to embarking on the journey of reformulating a food and/or beverage product, it is generally important to have a clear set of aims and objectives, including considerations of 'must-have' and 'nice-to-have' outcomes. These can play a key role in shaping the requirements throughout the reformulation process and help prepare for the challenges which may lie ahead. Whatever the driver for product innovation and reformulation may be, if you choose to reformulate, this guideline can help provide insight into the reformulation or new product development journey.



Aspects to consider when innovating and reformulating food & beverage products



Overarching themes and considerations may include:

Cost

Sustainability

Supply Chain

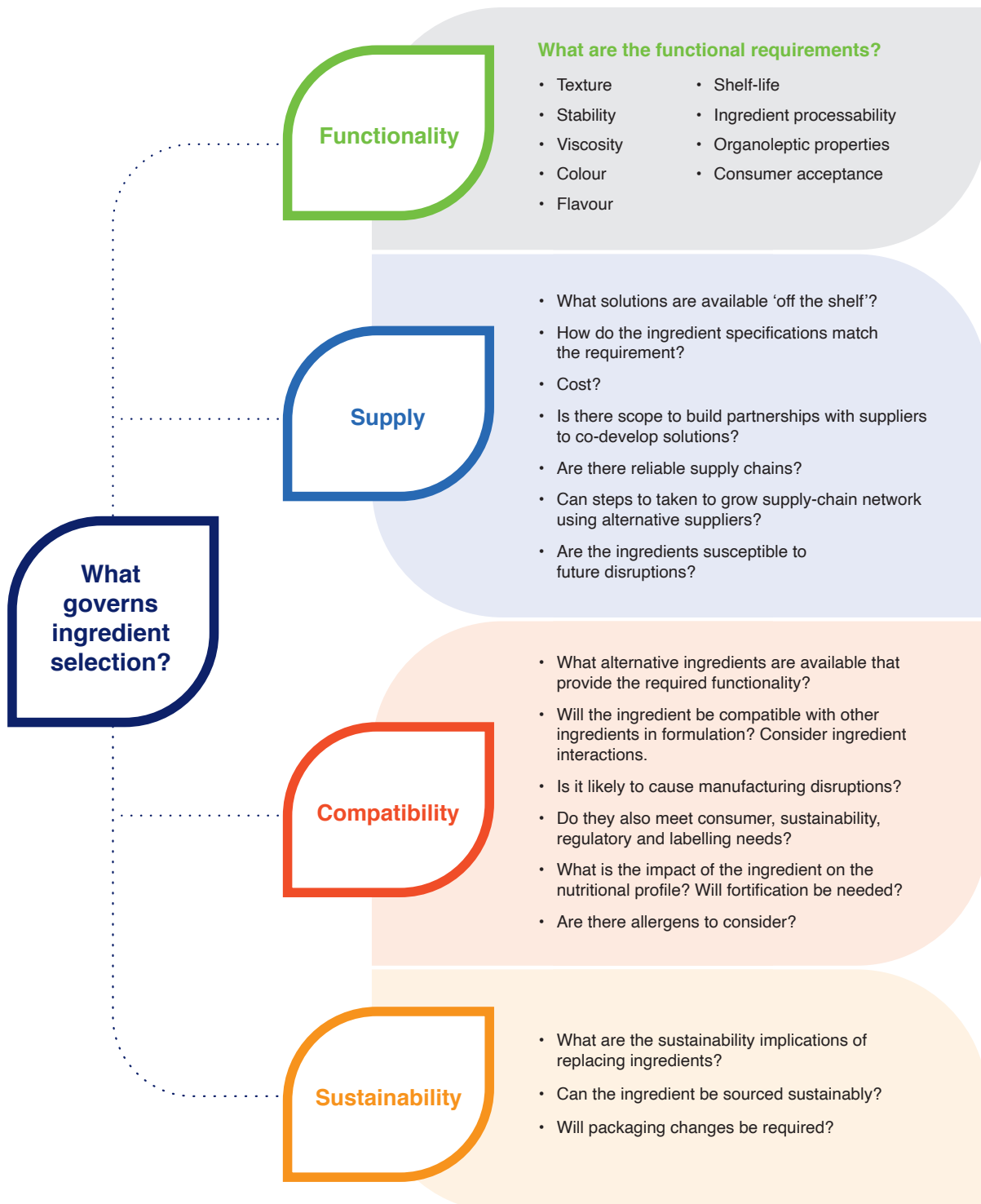
Nutritional Impact

Reformulation may have a high level of complexity, therefore it may not always be possible or desirable and so the development of a new product or reformulating an existing product may seem daunting. This document aims to outline the key steps and considerations that may be adopted on a voluntary basis. The relevance of the considerations outlined

herein is likely to require assessment on a case-to-case basis. For example, it may not be possible to reformulate certain products due to the intrinsic nutritional composition, such as lactose content of dairy products and sugar content of fruits.

Ingredients Considerations

Establishing the desired properties and functionalities of the product is critical for the identification and selection of suitable ingredients. There are other key aspects that feed into the ingredient selection which need to be weighed into the decision process as these may introduce potential risk factors governing the overall success of the reformulation. For example, a new ingredient may meet all the functionality requirements, however it may be susceptible to a disruptive supply chain or may not meet regulatory requirements of the intended market. Whilst each individual company may need to tailor the considerations based on their product and business needs, some of these key questions to be considered are illustrated in the figure below.



Production Considerations

Production considerations are a key aspect when reformulating an existing product or innovating a new product. This may involve identifying new production methods when altering product composition or even adapting or optimising current manufacturing parameters according to the processability of specific ingredients. When reformulating or innovating a product, it may be necessary to also think about the following:

Reformulation



Production options and requirements

Production parameters

Impact of production methods on ingredients

Impact of production changes on other production lines. Consider cross-contamination, production capacity and timeline

Impact on sustainability metrics (e.g. energy cost, water usage)

Production limitations (e.g. dry form vs wet form ingredients, viscosity limitations)

Updates / Changes to quality control, quality assurance and food safety (e.g. microbial risks, allergens)

Additional considerations for product innovation



Production Technology requirements for formulation product safety and product delivery. Consider:

- Preservation methods to enhance shelf life (standard retort, pasteurisation etc)
- Filling condition requirements (clean fill/aseptic conditions)
- Packaging (packaging that can tolerate production requirements)

Regulatory Considerations

It is best practice to account for current and emerging regulatory considerations from conception of the product through to product launch, including both ingredients and processing aids. The requirements for on-pack nutritional labelling should also be taken into account.

From an ingredient perspective, there may be compositional criteria for the product under design at both EU level and EU Member State level. Examples include the EU Chocolate Directive, which is implemented at Member State level, and yoghurt for which compositional standards exist in some Member States.

Food ingredients such as additives (including colours, preservatives, sweeteners) and flavourings need to be approved and may also have maximum usage levels. These usage levels will depend on the application matrix, and possibly the ingredient function. There is no list of approved processing aids at EU level, however some Member States have positive lists, e.g. France. It is also worth noting that imported ingredients may not comply with EU legislation, therefore verification of their approval status will be required. Even if an ingredient is approved in another region or market, it does not necessarily mean that it can automatically be used in the EU. Therefore, regulatory verification will be important.

Ingredients may be considered novel in the EU in the absence of a demonstrated significant history of consumption in the EU prior to 15 May 1997. If considered novel, the ingredient would require a regulatory authorisation (or one may already exist with restrictions on use).

From a production perspective, manufacturing technologies can also be considered novel and may require regulatory authorisation (similar to ingredients). Some production methods which are critical to food safety (e.g., for products of animal origin) require additional hygienic controls and require approval. Reformulation may impact this approval.

Changes to the formulation may also require a mandatory change to the product label, e.g., changes to ingredients list, nutrition declaration, claims or product name. If there is an intent to make any claims about the product (e.g., health, nutrition, or marketing claims), there may be requirements that need to be met. Claims may be considered in the early stages of reformulation to assess:

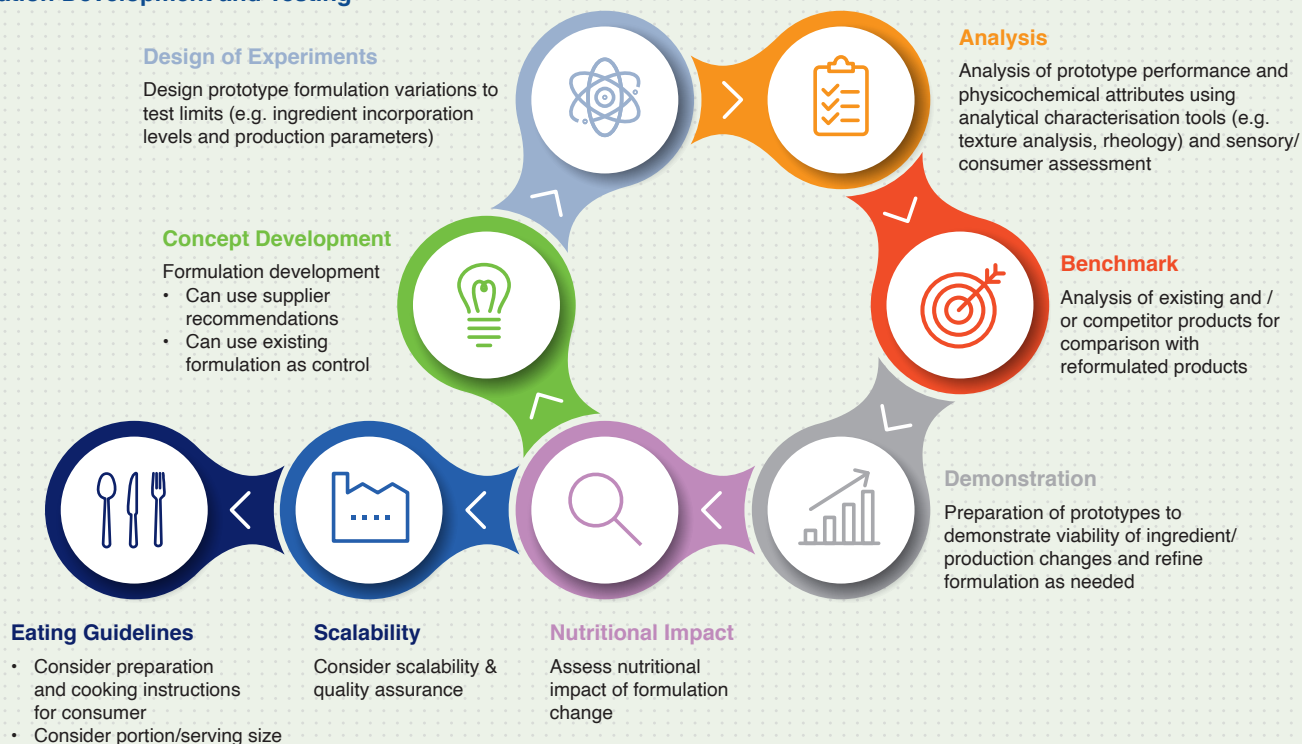
- **Are the claims allowed for the product in the desired market?**
- **Can the claims be substantiated?**
- **How can the product be designed to meet the criteria?**



Product Taxes

Whilst the EU has a tax policy strategy which focuses on eliminating tax obstacles to cross-border activity, Member States are free to choose the tax systems they consider most appropriate, including VAT rates. Tariff codes vary depending on the type of product. Several Member States have implemented other fiscal measures on food and drink products.

Formulation Development and Testing



Shelf-life and Product Safety Considerations

It is best practice to consider food safety implications from an early stage in the product design, and throughout the product development stage. Changes to the formulation may impact the microbiological safety and stability of the product of the product and may require changes to other aspects of the recipe, production, packaging and / or shelf-life to compensate. For example, salt and / or sugar are typically used for preservation of some foods (e.g., cheese, jam) and any change in their levels may alter the shelf-life. Therefore, shelf-life testing may need to be conducted on new formulations guided by regulations.² Additionally, the organoleptic properties of the product may be affected which may impact the overall consumer acceptance. Packaging options may also need to be reviewed and selected based on product requirements (e.g., with appropriate barrier properties to achieve the desired shelf-life of product).

Additionally, introduction of new ingredients or production changes may increase the risk of existing food safety hazards or introduce new food safety hazards including allergens to the production facility. A review of the Hazard Analysis and Critical Control Points (HACCP)³ plan may be required to assess risk and ensure adequate controls are in place. Sourcing new ingredients from new suppliers may also introduce additional risks to the supply chain, therefore a Threat Assessment and Critical Control Points (TACCP) and Vulnerability Assessment and Critical Control Points (VACCP) plans may also require review. TACCP protocols focuses on food tampering, intentional adulteration of food, and food defence whilst VACCP also focuses on food fraud, though its scope includes systemic prevention of any potential intentional / unintentional adulteration of food by identifying the vulnerabilities in the supply chain.

²Regulation (EC) 2073/2005 on microbiological criteria for foodstuffs – requires that food business operators, at each stage of food production, shall take measures as part of their procedures based on HACCP principles together with implementation of good hygiene practice, to ensure:

a) process hygiene criteria are met


b) that the food safety criteria applicable throughout shelf-life can be met under reasonably foreseeable conditions of distribution, storage and use

³Relevant regulations may also include Regulation (EC) 178/2002, Regulation (EC) 852/2004, Regulation (EC) 853/2004

Consumer & Sensory Testing

Consumer and sensory panel testing are key steps within the reformulation journey. Reformulation can have an impact on the flavour profiles, aroma, texture, appearance, amongst others. Whilst analytical testing can help assess the product performance, functionality, and attributes to an extent which accelerates the formulation development and testing phase, panel testing can validate analytical findings by measuring and analysing consumer response to product attributes including taste, appearance, texture, and smell. Consumer and sensory testing can also be useful in determination of product shelf-life and storage conditions. For example, studies can be conducted to correlate storage time and conditions with perceptions of off-flavours and texture changes by consumers.

Trained sensory panel tests typically deal in measured facts, whereas consumer panel tests may deal in opinions. There are also other tools available for consumer assessment such as social media listening which can be used to understand consumer perception and concerns about ingredients and allow exploration of market penetration.



The most common consumer tests are for simple benchmarking, which may be against a competitor product or against an old recipe. In its simplest form, product testing may involve comparison of overall liking scores (e.g., on a 9-point scale) along with other key attributes such as appearance, aroma, flavour, and texture. Often, overall preference scores and ranking may also be included. By using scores of specific product characteristics, these tests can also be used to identify drivers of liking. However, these are always assessed as a matter of opinion, for example determining if the consumers find the product to be e.g., too sweet relative to a benchmark.

Sensory trained panels quantitatively measure the sensory characteristics of a product using specifically generated vocabulary to characterise the product. Whilst there are various forms of sensory testing, profiling tests are commonly used during product innovation. As an example of a profiling test, a sensory panel can create a profile of the original product, competitor products, and any reformulated prototypes by measuring the sensory properties. Subsequent statistical analysis of the results can be used to quantitatively measure the differences between attributes. Analytical characterisation (such as an electronic nose) can also be used to complement sensory trained panel. For reformulated products, discrimination tests are typically employed to determine if a product has changed following reformulation.

Consumer and sensory testing can also be combined to generate preference mapping which helps form an overall picture of the product by drawing correlations between consumer liking and sensory scores. This can provide a deeper insight into the drivers for consumer liking (and disliking), using a more measured approach than solely using consumer testing.

If there is an intention to add claims to the product, such as: 'liked by our consumers' or 'improved recipe', then it may need to be substantiated by a consumer panel. However, for claims such as: 'juicier than ever' or 'sweeter taste', then a trained panel would be more appropriate. Additionally, it is worth checking the ISO standards and ASTM standards which govern the test methods and sample/panel size requirements for sensory and consumer claims.

Case studies

CASE STUDY: Reformulation of reduced-fat Greek-style yoghurt COMPANY: Lacteos Goshua

AIMS AND OBJECTIVES

Based in Navarra, Spain, Lacteos Goshua produce desserts, curd, and yoghurt using locally sourced ingredients and fresh milk from the Pyrenees.

Guided by the Strategy for Nutrition, Physical Activity and Prevention of Obesity (NAOS) in Spain, Lacteos Goshua wanted to offer healthier choices for their customers. The aim was to develop a new Greek-style yoghurt with significantly reduced fat content compared to the direct competitor products, without compromising on the richness and quality of the product.

INGREDIENT & PROCESSING

Reducing fat content typically results in a loss of viscosity and altered texture, which poses a key challenge. They tackled this challenge using innovative industrial technologies in combination with the use of locally sourced fresh milk.

DEVELOPMENT & TESTING

Trialling and optimising the processing technology was key to maintaining the creaminess of the product. In addition, optimisation of the acidity was also another key factor to obtain the right viscosity and texture.

The shelf-life of the product was unaffected during shelf-life testing, and consumer testing was conducted showing a positive result when benchmarked against the market leader.

RESULTS & OUTCOMES

Using innovative mixing technologies, together with their expertise, and know-how, Lacteos Goshua were able to maximise the creaminess and texture of their Greek-style yoghurt, whilst reducing the fat content by 50% compared to the market leader. The product development took approximately six months from inception and has been received positively by their customers.



CASE STUDY: New product development of functional Breakfast Boosts

COMPANY: Good4U

AIMS AND OBJECTIVES

Based in Sligo, Ireland, Good4U use nutrient-dense ingredients to create nutritious products that are tailored to give functional health benefits. They were interested in expanding their product portfolio and bring innovation to the health focused products category throughout personalised nutrition.

The aim was to launch a range of functional Breakfast Boosts to the grocery category in major retailers in Ireland and the UK, targeting consumer health concerns such as immunity, multivitamins, and protein.

INGREDIENT & PROCESSING

Good4U used a stage gate approach for their new product innovations, from concept to launch, starting with an initial research phase to identify meaningful unique ideas. The intention was to maximise current resources and bring the product to market using existing technology.

A project was undertaken to rationalise ingredient list. Apart from a limited number of ingredients, they worked with existing approved suppliers which helped to streamline and accelerate the process. Good4U only use plant-based ingredients to provide functionality and nutritional profile. Ingredients such as acerola cherry extract was used for Vitamin C, a UV grown mushroom for vitamin D2, pumpkin seed for zinc and sunflower seed for Vitamin E.

DEVELOPMENT & TESTING

Trial runs were conducted to validate the product formulation and manufacturing processes to ensure they can produce the product according to the requirements. The trials also validated proposed packaging materials and methods.

The samples were assessed by a taste panel comprising the product development team and any additional personnel not related to the project and compared against a benchmark product. This was followed by sensory analysis of products from the trial runs, organoleptic assessment, chemical/nutritional analysis, and microbiological analysis.

A shelf-life assessment was also conducted in accordance with documented procedures reflecting conditions (where possible) experienced during storage, transportation, and handling by the customer.

REGULATORY CONSIDERATIONS

Since Good4U were making a number of health claims in relation to immunity and protein, the recipes had to be validated by a UKAS accredited laboratory during the development process to ensure that the claim met and complied with current EU regulations and were EFSA approved. Any novel ingredients included also had to be labelled accordingly, for instance chia had to have its full name declared on back of pack (chia salvia Hispanic L).

RESULTS & OUTCOMES

Good4U launched their Breakfast Boost range and have successful listings with three Breakfast Boost lines (Immune, Vitamin, and Protein) in two major retailers in Ireland and UK, with new packaging formats being launched into international markets and an imminent new launch with a UK retailer.



CASE STUDY: Reformulation to increase fibre content of bakery products

COMPANY: Tower Bakery*

AIMS AND OBJECTIVES

Based in Abernathy, Scotland, Tower Bakery own five own-brand retail stores, in addition to third-party outlets and local authority contracts.

In response to regulatory changes in product nutritional requirements, Tower Bakery were keen to explore increasing the fibre content of their white bread rolls to meet retailer's specific requirements without impacting the appearance and colour of the product.

INGREDIENT & PROCESSING

Research was undertaken to identify and source high fibre flours that would meet the fibre content requirements without causing any changes in the colour of the product.

Powdered flours that maintain a light-coloured appearance upon baking were identified as a potential route to improving fibre content without affecting appearance.

Functionality of the alternative ingredients were similar to the wheat flour used in the existing formulation, so no processing adjustments were required.

DEVELOPMENT & TESTING

Various flour alternatives and formulations were sampled by the development team. Repeated trials were required to fine-tune the fibre content without impacting the appearance.

RESULTS & OUTCOMES

The fibre content was more than doubled from 2.1 g per 100 g to 4.3 g per 100 g in the final product. The learnings can be taken forward to increase the fibre content in other products across the Tower Bakery range.



*Source: FDF Scotland: <https://www.fdfscotland.org.uk/dfd/resources/case-studies/dfd-scotland-case-studies/reformulation/tower-bakery/>

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