Pancake reformulation and technical guidance

The Food Standards Agency in Northern Ireland, in partnership with the College of Agriculture, Food and Rural Enterprise, have created guidance to help businesses produce pancakes with reduced sugar and salt.
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Introduction

The Food Standards Agency's (FSA) Making Food Better (MFB) programme supports Northern Ireland food businesses to make the food environment healthier through reducing calories, saturated fat, sugar, and salt in the food they produce, sell or serve, reducing portion size, providing nutritional information and delivering responsible promotions.

Bakeries, in terms of gross turnover, are a major contributing sub-sector to the Northern Ireland food and drinks processing sector (DAERA, 2023). Products made by this sector are popular amongst Northern Ireland consumers.

The National Diet and Nutrition Survey highlights bakery products as a key contributor to calories, saturated fat, sugar and salt (Bates et al., 2019). Furthermore, Kantar (2022) data suggests "morning goods", of which pancakes are included, contributes to 3% of total energy (kcal) purchasing. Pancakes, specifically, are a popular baked/morning good of choice in Northern Ireland (Mintel, 2022, Bread and Baked Goods, Ireland). Therefore, reformulation in this category has the potential to contribute towards improving the dietary intake of the Northern Ireland population and aligns with the objectives of the MFB programme.

The FSA in conjunction with the College of Agriculture, Food and Rural Enterprise (CAFRE), Loughry Campus carried out a sampling programme of pre-packed pancakes sold in retail outlets across Northern Ireland to determine portion sizes and nutritional composition.

There are two pancake offerings available in terms of size: a standard size pancake weighing an average 41g and a large size pancake weighing an average 84g. The smallest pancake weighed 26g and the largest weighed 138g. The average sugar content for pancakes sampled was 15.04g of sugar per 100g.

Consumer analysis indicated that two standard sized (41g) pancakes was generally considered to be a portion.

Technical role of ingredients

Flour

Flour is the main building block in pancake batter, primarily composed of starch and proteins. The proteins interact to form gluten when mixed and hydrated. This provides elasticity and strength to the batter (Chanvrier et al., 2007). The starches in flour absorb moisture and contribute to the pancake's set structure and tender crumb (Wang et al., 2015). The type of flour used can influence the final product. Soft wheat flours are recommended as the protein content ranges from 8 to 10%, providing good mouthfeel and a less chewy texture which is desirable in a pancake.

Raising agents

Raising agents, such as baking powder and baking soda, are chemical leaveners which produce carbon dioxide when they react with moisture and an acidic ingredient like buttermilk (Palier et al., 2022). The released gas forms bubbles within the batter, which expand on cooking, causing the pancake to rise and become fluffy. Depending on the ingredient used, the timing of this reaction can be essential. The amount of raising agent must be carefully measured; excessive amounts can impart a bitter taste, while insufficient quantities may result in dense pancakes (Asamoah et al., 2023).

Buttermilk

Buttermilk, a fermented dairy product, reacts with leavening agents, producing carbon dioxide that aids in leavening, contributing to a tender and fluffy texture. The lactic acid in buttermilk also breaks down the structure, resulting in a softer crumb. Additionally, buttermilk imparts a unique flavour profile which enhances the overall taste of the pancakes. Its viscosity contributes to the batter's consistency which helps even cooking (Sodini et al., 2006).

Fats

Fats influence both texture and flavour in pancake batter. Incorporating fat into the batter tenderises the structure of the pancakes and results in a softer crumb (Mohammadi et al., 2024). Fats also contribute to the batter's viscosity, affecting the spread and thickness of the pancakes during cooking. Fats enhance flavour richness and promote a desirable mouthfeel. The type of fat used can impart different characteristics; for example, butter adds a distinct flavour, while oils provide moisture without altering taste significantly. Balancing the fat content is essential, as excessive fat can lead to greasy pancakes, whereas insufficient fat may result in a dry and tough texture (Kumari et al., 2011).

Sugar

Sugar serves multiple functions beyond sweetening in pancake batter. It contributes to the Maillard reaction during cooking, promoting browning and developing a flavourful crust (Lee et al., 2022). Sugar also influences the batter's consistency by competing with flour for liquid absorption, which reduces gluten formation and resulting in a more tender pancake. Sugar also retains moisture and helps to keep pancakes moist and soft (Godefroidt et al., 2023). Careful measurement is important, as excessive sugar can cause over-browning and a sticky texture, whereas too little could result in pale and less flavourful pancakes (Milner et al., 2020).

Salt

Salt, though used in small quantities, is a critical component in pancake batter. It enhances the overall flavour by balancing sweetness and suppressing bitterness, making the pancakes more palatable. Salt also strengthens the gluten network, improving the batter's cohesiveness and contributes to a better crumb structure. Additionally, salt can moderate the activity of leavening agents, ensuring a controlled rise and preventing overly airy or collapsed pancakes. Accurate

measurement is essential, as excessive salt can overpower the flavour, while insufficient salt may result in bland pancakes (Ferrari et al., 2022).

Egg

Egg is a multifunctional ingredient in pancake batter, contributing to structure, leavening, colour and flavour. The proteins in egg coagulate upon heating, providing structure and stability to the pancakes. Egg also contributes to leavening; when beaten, they incorporate air into the batter, which expands during cooking, resulting in a lighter texture. The emulsifying properties of egg help to create a uniform batter by stabilising the mixture of fats and liquids, leading to a consistent texture. Additionally, egg adds moisture and richness, enhancing the flavour and contributing to a tender crumb. The yolks impart a yellow hue, enriching the visual appeal of the pancakes. The balance of egg in the recipe is crucial; too much egg can make the pancakes dense and custard-like, while too little can result in a lack of structure and cohesiveness (Yazici et al., 2021).

Portion size considerations

Food Technologists at Loughry Campus collected samples of plain pre-packed pancakes sold in retail outlets across Northern Ireland. Data was collated on portion size and nutritional composition. The average weights of the sampled pancakes were grouped into standard and large pancakes categories.

Weight of standard and large pancakes

	Average weight	Minimum weight	Maximum weight
Standard pancakes	40.76g	26.09g	55.27g
Large pancakes	83.74g	61.99g	137.70g

The weight of individual pancakes ranged from 26.09g to 137.70g. There was greater variation in weight among large pancakes. Sensory analysis tasting sessions carried out at CAFRE, Loughry Campus highlighted that 83% of respondents find an 80g portion of pancakes to be their acceptable portion size. This aligns with a portion size of two standard pancakes or one large pancake. The average nutritional content of sampled pancakes is provided below per 100g and per 80g portion. A typical portion of pancakes would provide 200kcal, 12.32g sugar and 0.89g salt.

Average nutritional information for pancake samples

Energy/nutrient	Per 100g	Per 80g
Energy (kJ)	1048	839
Energy (kcal)	249	200
Fat (g)	5.93	4.74
of which saturates (g)	0.92	0.74
Carbohydrate (g)	42.42	33.94
of which sugars (g)	15.40	12.32
Fibre (g)	1.63	1.30
Protein (g)	6.26	5.01
Salt (g)	1.11	0.89

Suggested reformulated recipe

The suggested recipe is based on ways to reduce sugar and salt in pancakes, by modifying a control recipe using substituted ingredients to mimic the functionality of the original ingredients. The recipes are for guidance and other parameters may need to be considered. More information on the ingredients used in the reformulated recipe can be found in the following section.

Control and reformulated pancake recipes

Ingredients	Control recipe %	Reformulated recipe %
Buttermilk	43.98	43.96
Plain wheat flour	32.98	32.97
Sugar	10.99	4.84
Liquid whole egg	7.33	7.33
Rapeseed oil	2.79	2.78
Baking powder	1.65	-
Salt	0.28	0.28
Oligofructose	-	4.40
Invert sugar	-	1.47
Low sodium baking powder	-	1.98

Role of ingredients used in the reformulated recipe

Oligofructose

Oligofructose is a prebiotic fibre derived from chicory root. It is used to reduce sugar content in pancakes while maintaining sweetness and texture. It has approximately 30–50% of the sweetness of sucrose and can partially replace sugar without compromising flavour. Oligofructose contributes to moisture retention, helping to keep pancakes soft and preventing dryness. Additionally, it enhances browning through the Maillard reaction, improving the colour and caramelised flavour of the pancakes. Due to its soluble fibre nature, oligofructose also increases the fibre content and improves the nutritional profile of pancakes. However, excessive use can lead to a slightly different texture and gastrointestinal discomfort in sensitive individuals (Niness, 1999).

Invert sugar

Invert sugar, a mixture of glucose and fructose, serves as an effective ingredient in pancake batter, offering enhanced sweetness and moisture retention. It is sweeter than sucrose, allowing for a reduction in total sugar content. Excessive sugar intake has been associated with increased risk of weight gain and dental caries (Scientific Advisory Committee on Nutrition, 2015). The ability of invert sugar to absorb water helps maintain pancake softness over time, reducing staling. Additionally, invert sugar lowers the crystallisation tendency of sugars, ensuring a smoother batter consistency and promoting uniform browning through the Maillard reaction. The syrup-like consistency of invert sugar affects batter viscosity, slightly altering pancake texture compared to granulated sugar. Its rapid caramelisation can enhance the colour and depth of flavour in cooked pancakes. However, its use must be carefully measured to prevent excessive browning or a sticky texture (Safarik et al., 2009).

Low sodium baking powder

Low sodium baking powder is a key leavening agent that allows for reduced sodium levels in pancakes without compromising rise and texture. Traditional baking powders contain sodium bicarbonate, which contributes to overall dietary sodium intake. Low sodium alternatives replace sodium bicarbonate with potassium bicarbonate, maintaining the release of carbon dioxide for proper leavening. This substitution helps to create pancakes with the same light and fluffy texture while reducing the sodium content. A high intake of sodium can be associated with certain health risks such as hypertension (Jia et al., 2021). Additionally, potassium bicarbonate does not introduce off-flavours, ensuring the pancakes retain their original taste. The reactivity of low-sodium baking powder remains similar to standard formulations, requiring proper acid-base balance for optimal gas release. Careful formulation adjustments may be necessary to maintain the desired batter consistency and final product texture (Chen et al., 2019).

Nutritional content considerations

The nutritional content of both the control and reformulated recipes were calculated to help bring the reformulated recipe in line with the current targets indicated in the UK Government's guidelines for calorie, sugar and salt (Public Health England, 2017; Public Health England, 2020).

Nutritional information for control and reformulated recipes

Energy/nutrient	Control recipe per 100g	Reformulated recipe per 100g	UK Government's calorie, sugar and salt reduction guidelines
Energy (kJ)	1033	983	-
Energy (kcal)	248	235	220kcal to 325kcal per portion*
Fat (g)	4.90	4.90	-
of which saturates (g)	0.60	0.60	-
Carbohydrates (g)	43.60	38.30	-
of which sugars (g)	15.10	9.80	10.00g/100g
Fibre (g)	1.60	6.10	-
Protein (g)	6.70	6.70	-
Salt (g)	1.28	0.94	1.01g/100g (average) 1.19g/100g (maximum)

*A typical 80g portion of the reformulated pancakes contains 188 kcal.

Energy and sugar content of pancake toppings

Consumers will generally add toppings to pancakes. These are worth considering as they will contribute to the nutritional content.

Typical energy and sugar information for toppings

Ingredients	Calories (kcal) per 100g	Sugar (g) per 100g
Butter	744	0.60
Sugar	394	105.00
Syrup	298	79.00
Jam	261	69.00
Chocolate spread	575	59.40
Bacon	295	0

Lemon	79	3.20
Peanut butter	607	6.70
Honey	288	76.40
Mixed berries	38	6.90

Further considerations

- Avoid overmixing which can lead to excessive gluten development, resulting in tougher pancakes. Undermixing may cause insufficient structure, leading to flat pancakes
- Allow batter to rest for at least 10 minutes before cooking.
- Using a portion control utensil or dispenser will aid consistency of pancake portion control.
- When cooking ensure pancake has started to solidify and bubbles have popped before gently flipping.
- Sieve flour for lighter pancake texture.
- If pancake toppings are suggested on packaging, some healthier options could be provided, for example fruit.

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