



Ice Cream Reformulation and Technical Guidance



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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.

‘Ice cream, lollies and sorbets’ are one of the top ten contributors to take home saturated fat (3%) in Northern Ireland (Kantar Worldpanel, 2023). This category also contributes 2.5% to total take home sugar in Northern Ireland and is included in the UK Government’s calorie and sugar reduction programmes (PHE, 2017; PHE 2020). Gelato is also becoming a popular option with around 1 in 5 adults (19%) in the UK saying they’ve eaten gelato in the three months to October 2023 (Mintel, 2024).

Ice cream and gelato have been identified as a category of particular relevance due to the large dairy industry in Northern 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 Making Food Better programme.

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

Across the portion sizes sampled, the smallest serving size was an ice cream cone at 46.5g whilst some of the larger portion sizes collected in the survey were more than 400g. The top three most popular over-counter ice cream/gelato flavours sold were honeycomb, followed by vanilla, then Kinder Bueno. The results indicated the most popular choice, was a medium portion size.



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Technical role of ingredients

Ice cream is an emulsion consisting of air, water, fat, milk solids not fat (MSNF), sweeteners, stabilisers, emulsifiers and flavourings. Gelato is an Italian-style ice cream which is generally lower in fat (4-8%) and higher in sugar than regular ice cream formulations. Gelato is traditionally soft-frozen with intense flavours and is scooped from well-decorated, shallow serving trays (Goff and Hartel, 2013).

Fat

Ice cream typically has a fat content of 8-10% by weight, though in premium ice creams it can be as high as 15-20%. The major sources of fat used in industrial ice cream are cream, milk, butterfat and vegetable fat. The best source of dairy fat is fresh cream. In addition to providing the right melting profile, it also has the highest concentration of fat which provides ice cream with a smooth, creamy texture and dairy flavour. Milk contains less fat than cream but still contributes to a rich texture. Vegetable fat such as oils and cocoa butter can also be used to provide specific flavours and textures. Fat performs other fundamental functions including contributing to product stability and quality. It helps to stabilise the air bubbles introduced during the churning process and slows down the rate at which ice cream melts, allowing it to retain its shape and texture for longer (Cree, 2017).

Milk solids not fat

Milk solids not fat (MSNF) refer to the non-fat components of milk including proteins, lactose, and minerals. While they don't directly contribute to the fat content, they enhance the texture, creaminess, flavour

and overall quality of the ice cream. MSNF helps bind water and fat molecules together, stabilising the mixture and preventing ice crystals from forming which serves to improve the smoothness and consistency of the final product. Skimmed milk powder is an example of a traditional source of MSNF as it is rich in casein, whey proteins, lactose and minerals (Clarke, 2015).

Sweeteners

Nutritive and non-nutritive sweeteners are used in ice cream production to provide sweetness, enhance texture and improve product stability. Sucrose is the most used sweetener in ice cream production due to the level of sweetness it imparts. Sweeteners help control the freezing point of the ice cream mixture, preventing it from becoming too hard during freezing thus improving the texture and mouthfeel. Consumer interest in 'no added sugar' or 'sugar free' formulations continue to gain momentum. Non-nutritive artificial sweeteners (such as sucralose and stevia) provide sweetness to the product without contributing to the sugar content which allows for reduced-calorie or sugar-free ice cream offerings.

Alternatively, nutritive or 'caloric' sweeteners such as sucrose, contribute 4 calories per gram metabolisable energy to the diet when used to make ice cream (Clarke, 2015; Cree, 2017).

Stabilisers

Stabilisers such as guar gum, locust bean gum and carrageenan are essential ingredients that are added during ice cream production to maintain the texture, consistency and quality of the product over time. They help maintain a creamy texture by inhibiting the growth of ice crystals which prevents the formation of a gritty texture. Stabilisers work to prevent syneresis (the release of water from the ice cream, leading to a loss of moisture and undesirable texture) by binding water molecules, maintaining moisture content, and preventing the ice cream from becoming too hard or icy. These functions help contribute to the extended shelf life of ice cream products (Goff and Hartel, 2013).

Emulsifiers

An emulsifier is a substance that produces a stable suspension of two liquids that do not mix naturally. Ice cream is an emulsion of fat droplets dispersed in a water-based mixture and emulsifiers are crucial to stabilise this blend of fat and water to prevent separation during freezing and storage. In addition to offering stability, emulsifiers also help improve the melting resistance of ice cream by forming a protective barrier around the fat globules. Increasing the melting resistance can help with moulding and artisan manufacture.

Emulsifiers are typically integrated with stabilisers in proprietary blends however, they serve separate roles. Traditionally, egg yolk was used as an emulsifier in ice cream. However, in modern ice cream production, common emulsifiers used include esters of fatty acids, mono and diglycerides and polysorbate 80 which help ensure precise stability, whipping properties and shelf life, crucial for industrial production (Goff and Hartel, 2013).

Flavourings

Flavourings in ice cream serve to enhance its taste and aroma. Flavours can be natural (i.e. extracted from sources such as fruits and plants) or synthetic (compounds comprised of aromatic chemicals). Traditional flavours such as vanilla, chocolate and strawberry remain staple offerings however, the last decade has seen an increase in confectionary, bakery and exotic fruit flavouring combinations. Flavourings for ice cream are available in various forms to accommodate difference in preferences and manufacturing processes. Liquid flavourings such as vanilla extract are mixed into the ice cream base prior to freezing and offer consistent flavour distribution. Semi solid flavourings such as fruit purées and nut butter can be mixed into the ice cream base or layered within the product. These add layers of flavour and texture to the ice cream. Solid flavourings include ingredients like chocolate pieces, nuts and candy pieces, which instead provide bursts of flavour to the ice cream (Clarke, 2015).

Portion control considerations

CAFRE, Loughry Campus collected data on typical small, medium and large servings of ice cream and gelato from a representative number of outlets across Northern Ireland. The outlets were asked to serve typical small, medium and large portion sizes for both cones and tubs for vanilla, honeycomb, strawberry and luxury flavours.

Average weights for small, medium and large servings of ice cream/gelato

	Small cone average weight	Medium cone average weight	Large cone average weight
Ice cream			
Vanilla	86.46g	113.30g	178.17g
Honeycomb	89.85g	168.86g	194.77g
Luxury	76.53g	127.67g	185.96g
Gelato			
Vanilla	89.84g	153.64g	233.04g
Strawberry	76.06g	144.69g	219.97g
Luxury	95.16g	178.83g	262.73g

	Small tub average weight	Medium tub average weight	Large tub average weight
Ice cream			
Vanilla	94.70g	199.61g	283.46g
Honeycomb	98.95g	186.95g	264.56g
Luxury	124.96g	205.68g	318.09g
Gelato			
Vanilla	96.96g	181.31g	270.55g
Strawberry	76.79g	136.07g	219.97g
Luxury	95.16g	178.83g	262.73g

Nutritonal value and portion size considerations

Based on questionnaire responses, medium portion sizes are most popular for both cones and tubs. The average weights table demonstrates that medium tub portion sizes were, on average, slightly heavier than medium cone portion sizes. There was a variation of 65.53g between the smallest and largest medium cone servings and similarly 69.61g between the smallest and largest medium tub servings.

A medium vanilla ice cream tub weighing 151.59g would provide 278 kcal / 27.86g sugar / 15.07g fat. A medium vanilla gelato tub weighing 179.26g would provide 324 kcal / 37.20g sugar / 16.60g fat.

Suggested reformulated recipes

These suggested recipes are based on ways to make healthier ice creams, by using replacement ingredients to mimic the functionality and modifications to control recipes. The recipes are for guidance and other parameters may need considered.

Ice cream base mix recipe 10% fat

Ingredients	Control recipe %	Reformulated recipe %
Whole milk	60.19	60.19
Whipping cream	20.61	20.61
Skimmed milk powder	4.75	4.75
Sugar	9.80	4.30
Dextrose	4.20	2.50
Fructose	-	3.00
Oligofructose	-	4.20
Emulsifier/stabiliser	0.45	0.45
Flavourings can be added to the base mix recipe at the percentage rate detailed:		
Natural vanilla flavouring: 0.2%		
Strawberry paste with sweetener: 5%		
Chocolate paste: 7%		

Typical nutritional information for reformulated recipes

Energy/nutrient	Vanilla per 100g	Strawberry per 100g	Chocolate per 100g	UK Government's calorie and sugar reduction guidelines
Energy (kJ/kcal)	823/197	849/203	942/225	220 to 325 kcal as per portion
Fat of which saturates	10.40g 6.80g	9.80g 6.30g	12.40g 6.90g	
Carbohydrate of which sugars	15.70g 15.00g	18.90g 17.40g	17.50g 16.80g	18.60g/100g
Fibre	3.90g	3.60g	3.80g	
Protein	3.70g	4.60g	4.10g	
Salt	0.26g	0.16g	0.15g	

Ice cream/gelato style base mix recipe 8% fat

Ingredients	Control recipe %	Reformulated recipe %
Whole milk	62.71	62.71
Whipping cream	15.11	15.11
Skimmed milk powder	4.68	4.68
Sucrose	17.00	8.33
Fructose	-	3.57
Oligofructose	-	5.10
Emulsifier/stabiliser	0.50	0.50
Flavourings can be added to the base mix recipe at the percentage rate detailed:		
Natural vanilla flavouring: 0.2%		

Typical nutritional information for reformulated recipe

Energy/nutrient	Per 100g	UK Government's calorie and sugar reduction guidelines
Energy (kJ/kcal)	777/185	220 to 325 kcal as per portion
Fat of which saturates	8.40g 5.40g	
Carbohydrate of which sugars	18.10g 17.70g	18.60g/100g
Fibre	4.70g	
Protein	4.10g	
Salt	0.18g	



Calorie information for cones, toppings and additions

It is worth considering that ice cream and gelato are likely to be consumed with cones, toppings and/or additions, which will add to the nutritional value.

Typical energy and sugar information for cones

	Energy (kcal) per cone	Sugar per cone
Ice cream cone	22	0.11g
Waffle cone	69	5.25g
Waffle cones dipped in chocolate	126	9.77g
Rainbow waffle cone	122	8.52g

Typical energy and sugar information for popular toppings and additions

	Energy (kcal) per 100g	Sugar per 100g
Sprinkles	424	91g
Honeycomb	362	75g
Flake	522	57g
Marshmallows	324	63g
Fudge pieces	399	60g
Chopped nuts	604	5g
Strawberry syrup	316	75g
Toffee syrup	331	73g
Chocolate syrup	315	70g

Further considerations

- ✓ Using consistent measurements/ scoop sizes may aid uniformity of portion sizes and prove financially beneficial to businesses.
- ✓ Addition of flavourings such as vanilla extracts with small dosage rates will have minimal impact on nutritional value and calorie content.
- ✓ Reducing portion size gradually so that it is still perceived to be 'normal' in size by the consumer may be most effective to reduce energy intake. (Haynes *et al.*, 2019)
- ✓ Natural sweetness can be provided from use of lactase enzyme and natural sweet flavourings.
- ✓ Consider the names or labels assigned to portion sizes. For example, a 'junior cone' may be more appealing to younger children than a 'baby cone' or 'children's cone'.
- ✓ Powdered base mixes and fruit pastes with sweeteners are available that can be used together or separately.



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