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Reformulation of Yogurt: The Accuracy of Nutrition Declaration on Food Labels for the Monitoring of Food Reformulation in Ireland

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Reformulation of Yogurt: The Accuracy of Nutrition Declaration on Food Labels for the Monitoring of Food Reformulation in Ireland

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Acronyms

Acronym	Definition
DRV	Dietary reference value
EC	European Commission
EFSA	European Food Safety Authority
EU	European Union
FSAI	Food Safety Authority of Ireland
g	gram
INFORMAS	International Network for Food and Obesity/Non-communicable Diseases (NCDs) Research, Monitoring and Action Support
Kcal	Kilocalorie
kJ	Kilojoule
NANS	National Adult Nutrition Survey
NCD	Non-Communicable Disease
NMR	Nuclear Magnetic Resonance
SPSS	Statistical Package for the Social Sciences
TE	Total energy
UK	United Kingdom
WHO	World Health Organization

Executive summary

Levels of overweight and obesity have doubled across the Irish population since the early 1980s (Department of Health, 2013). More than one-half of the Irish population are now overweight or obese, with only 40% of adults falling within a healthy weight range (Department of Health, 2015). *A Healthy Weight for Ireland: Obesity Policy and Action Plan 2016 – 2025* sets out a roadmap to reduce rates of overweight and obesity across the Irish population over a 10-year period (Department of Health, 2016). Reformulation of processed foods offers a cost-effective opportunity to reduce the saturated fat, sugar and salt content of many commonly eaten foods, which has been found to have a positive impact on obesity (McKinsey Global Institute, 2014). Action point 3.1 of *A Healthy Weight for Ireland: Obesity Policy and Action Plan 2016 – 2025* commits to setting food reformulation targets for total fat, saturated fat, sugar and salt with the food industry and monitoring progress in reaching these targets from 2016 to 2025.

In 2009, a reformulation framework was agreed to reduce salt by 16% over a 4-year period across the European Union (EU) (European Commission, 2009). In 2011, the reformulation approach was broadened under the European Commission's (EC's) National Initiatives on Selected Nutrients, starting with reducing saturated fat by 5% by 2016 and by a further 5% by 2020 (European Commission, 2011). In 2015, this framework addressed added sugar by promoting a voluntary reduction of 10% in processed food by 2020. Ireland has committed to the EC National Initiatives on Selected Nutrients and has made substantial progress in seeking voluntary commitment from industry on reformulation of salt and trans fats in processed foods, and in establishing a monitoring system to measure progress (Food Safety Authority of Ireland, 2016; 2018). The aims of this study were to examine the accuracy of the declared nutrition information in line with EC guideline nutrition labelling tolerances and to make a recommendation on the use of declared nutrition labels for the monitoring of food reformulation of total fat, saturated fat, and sugar in Ireland. The information collected as part of this study could also contribute to a baseline for monitoring food reformulation efforts of yogurts sold in the Irish retail food environment.

Yogurts, including yogurt alternatives,[1] identified in a 2016 cross-sectional market scan (n=578), were assigned a weighting based on manufacturer type (branded, own brand), product category (natural, flavoured and luxury) and declared nutrition content (Food Safety Authority of Ireland,

[1] This group will be referred to as 'yogurts' throughout this report.

2020). In 2018 yogurts (n=200) were randomly selected from these weighted groups. Yogurts were analysed in a laboratory using accredited methods for total fat, saturated fat and sugar.

The data was analysed using Microsoft Excel and IBM Statistical Package for Social Sciences (SPSS) (Version 25). As data was not normally distributed, median values were investigated for both label declarations and laboratory analysis using the Wilcoxon Signed-Rank test and the Spearman Rank-Order correlation.

EC guideline nutrition labelling tolerances were calculated by setting the initial bounds, applying the tolerance permitted for the level nutrient, giving consideration to whether or not a claim was made on the food, and finally applying the rounding principle as set out in Section 6 of the guidance document.

Of the tested yogurts, 7% (n=13), 5% (n=9) and 17% (n=33) were outside the EC guideline nutrition labelling tolerances for total fat, saturated fat and sugar, respectively (European Commission, 2012). In total, 45 yogurts were found to be outside the EC guideline nutrition labelling tolerances, 9 of which were outside EC guideline nutrition labelling tolerances for two or more nutrients. Analysed nutrient content was lower than was stated on the label in 71% (n=39) of the analysed yogurts that were found to be outside of EC guideline nutrition labelling tolerances. While this is a potential non-conformance with the labelling tolerance guidance, it is one that favours the consumer in terms of a healthier nutrient profile for yogurts on the market. However, analysed fat content was higher, with 77% (n=10) of the yogurts that were outside the EC guideline nutrition labelling tolerances for fat measuring higher fat content than declared. There was a statistically significant difference between median declared and analysed energy, total fat and sugar content per 100 g of yogurt. The difference between declared and analysed sugar content per 100 g of yogurt was statistically significant across all yogurt types. There was a positive correlation between energy content and portion size.

This study found declared nutrition labels were mostly in line with EC guideline nutrition labelling tolerances for total fat and saturated fat content of yogurts. However, 17% (n=33) of yogurts were outside EC guideline nutrition labelling tolerances for sugar. In the case of sugar and saturated fat, the study observed no systematic bias for placing yogurts on the market with higher nutrient content than that shown on the label. However, analysed fat content was higher, with 77% (n=10) of the yogurts that were outside guideline nutrition labelling tolerances for fat measuring higher fat content than declared. The findings of this study indicate that the declared nutrition labels may not reflect the true food reformulation efforts.

Based on the findings of this study, the following recommendations are made:

- When EC guideline nutrition labelling tolerances are accounted for, it is possible that declared nutrition labels may not reflect the true food reformulation efforts. This finding needs to be considered when developing a reformulation monitoring programme.
- Reformulation monitoring programmes relying on labelled nutrition information need to be 'fact checked' at regular intervals using a nutrition label verification method.
- Innovative food categories, such as yogurts, require regular monitoring to understand reformulation efforts in these food categories.
- There are numerous factors which influence variations in declared and analysed nutrient content of yogurts, and this requires further investigation with the food industry as it could affect reformulation monitoring.
- Additional food categories should be investigated using the same methodology in order to determine if the findings of this study apply to other food categories.

1. Introduction and background

Levels of overweight and obesity have doubled across the Irish population since the early 1980s (Department of Health, 2013). More than one-half of the Irish population are overweight or obese, with only 40% of adults living in Ireland being a healthy weight (Department of Health, 2015). Recent surveys indicate that the rate of overweight and obesity may be stabilising across the population; however, it is rising among lower socioeconomic groups (Bel-Serrat et al., 2018). Chronic diseases – particularly hypertension, coronary heart disease, stroke and type 2 diabetes – are on the rise in Ireland as a result of the growing overweight and obesity epidemic (World Health Organization, 2015).

A Healthy Weight for Ireland: Obesity Policy and Action Plan 2016 – 2025 sets out a road map to reduce rates of overweight and obesity across the Irish population over a 10-year period (Department of Health, 2016). The solutions to addressing overweight and obesity are multiple and complex. The Irish Obesity Policy and Action Plan seeks to address the key determinants of overweight and obesity as described by the World Health Organization (WHO), including the environment, access to healthy and affordable food, physical activity, exercise and leisure activity, cultural and societal norms, education and skill levels, genetic makeup and lifestyle choices (Commission on Social Determinants of Health, 2008).

A high and imbalanced fat, saturated fat and sugar intake is associated with an increase in non-communicable chronic diseases such as coronary heart disease, stroke, type 2 diabetes and cancer (Nettleton, Brouwer, Geleijnse and Hornstra, 2017) (Fiolet et al., 2018). Foods high in wholegrains, fruit and vegetables and low in saturated fat, sugar and salt are protective against non-communicable diseases. The European Food Safety Authority (EFSA) advises a reference intake of 30–35% of total energy (TE) from fat and as low as possible an intake of saturated fat for adults aged 18 years or older (European Food Safety Authority, 2017). The WHO advises that intake of saturated fat should be less than 10% of TE intake (World Health Organization, 2003). The WHO defines free sugars as “monosaccharides and disaccharides added to foods and beverages by the manufacturer, cook or consumer, and sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates” and recommends that intake of free sugars be less than 10% of TE intake; in addition, the WHO has a conditional recommendation, meaning that further stakeholder engagement is required before the recommendation is translated into a policy, of <5% of TE intake (World Health Organization, 2015). There is currently no dietary reference value (DRV) for sugar intake at European Union (EU) level. EFSA is in the process of reviewing the literature and drafting a scientific opinion on sugar intake; this is due to be published in 2021.

The Irish *National Adult Nutrition Survey* (NANS), published in 2011, found that mean total fat and total sugar, combined, made up 51% of TE in the diets of Irish adults (Irish Universities Nutrition Alliance; 2011). Fat contributed 34.1% of TE among Irish adults aged 18–64 years, which is marginally below the upper range of the DRV for fat from TE as set out by EFSA (EFSA, 2010). Saturated fat contributed 13.3% of TE intake among Irish adults aged 18–64 years (Walton et al., 2017). This is above the 10% limit set out by the WHO (World Health Organization, 2003). Additional analysis of the NANS dataset in 2017 found that overall sugar intake for Irish adults aged 18–65 years accounted for, on average, 17.1% of TE, with free sugars intake contributing 8.7% of TE (Tierney, McNulty, Nugent and Gibney, 2011) This is below the WHO recommended intake for free sugars of 10%, but above the conditional limit of 5% (World Health Organization, 2015).

Reformulation of processed foods offers an opportunity to reduce the saturated fat, sugar and salt content of many commonly eaten foods and has been found to have a positive impact on obesity and related chronic diseases in terms of cost-effectiveness (McKinsey Global Institute, 2014). In 2009, the European Commission published a food reformulation framework to reduce the salt content of foods by 16% over a 4-year period across the EU (European Commission, 2008). In 2011, the reformulation approach was broadened under the European Commission's (EC's) National Initiatives on Selected Nutrients, starting with reducing saturated fat by 5% by 2016 and by a further 5% by 2020 (European Commission, 2011). In 2015, this framework addressed added sugar, promoting a voluntary reduction of 10% in processed food by 2020. Ireland has committed to the EC National Initiatives on Selected Nutrients and, to date, has made substantial progress in seeking voluntary commitment from industry on reformulation of salt and trans fats in processed foods, and in establishing a monitoring system to measure progress (Food Safety Authority of Ireland, 2018) (Food Safety Authority of Ireland, 2016).

Step three of *A Healthy Weight for Ireland: Obesity Policy and Action Plan 2016 – 2025* sets out to secure appropriate support from the commercial sector to play its part in obesity prevention (Department of Health, 2016). This step recognises the shift in the global and national food environment towards increased availability of processed and ready-to-eat foods and the need for food industry leaders to produce products that are broadly aligned with the nutrition guidance in order to improve population health outcomes (Monteiro et al., 2013). Specifically, action point 3.1 of *A Healthy Weight for Ireland: Obesity Policy and Action Plan 2016 – 2025* is to agree food industry reformulation targets for Ireland and review progress towards reaching these targets (Department of Health, 2016). This will see Ireland's approach to food reformulation broaden beyond salt to

include energy, sugar and saturated fat. A Reformulation Sub-group of the Obesity Policy Implementation. Oversight Group has been established to set voluntary food reformulation targets for energy, saturated fat, sugar and salt in Ireland.

The Reformulation Subgroup has also been tasked with outlining a monitoring approach to measure progress towards achieving agreed voluntary food reformulation targets. Monitoring of food reformulation is complex and has been approached in different ways by different countries. A commonality between reformulation monitoring approaches is the use of declared nutrition labels to monitor nutrient content changes in foods over time.

In December 2014, Regulation (EU) No 1169/2011 came into effect. A requirement of this legislation is the provision of nutritional content (energy, total fat, saturated fat, carbohydrate, sugars, protein and salt) of pre-packaged food per 100 g. The availability of this nutrition information on all pre-packaged food provides a readily available means for monitoring the reduction of saturated fat, sugar and salt in food. European regulations require that the labelled nutritional values are average values for the food as manufactured, and that these average values can be based on analytical measurement or published values. In addition, EC guidance with regard to tolerances for the average nutrient values declared on a label sets out the variability accepted for official controls purposes in relation to the measured nutritional content of a food sample in comparison to the declared nutrition content on the label of that food (European Commission, 2012). The range of what is allowable depends on the type of food, whether a claim is made on the food and the type and amount of the nutrient in the food, e.g. EC guideline nutrition labelling tolerances for total fat is defined as; <10 g of fat per 100 g ±1.5 g, and 10–40 g of fat per 100 g ±20%. Consequently, it is acceptable for the actual nutrient value of a particular food item to differ from its labelled value, provided it is within the accepted tolerances. Research on the accuracy of declared nutrition labels for monitoring of nutrient content of food is an evolving field (Food Safety Authority of Ireland, 2010).

In 2016, the Food Safety Authority of Ireland (FSAI) undertook a market analysis of yogurts, including yogurt alternatives, to determine total fat, saturated fat and sugar content based on declared nutrition labels (Food Safety Authority of Ireland, 2020). Yogurts were chosen because they are a contributor of sugar and fat intake in the Irish diet, despite being considered a ‘healthy food’ (Tierney, McNulty, Nugent and Gibney, 2011) (Walton et al., 2017). It was decided to ‘sense check’ the labelled nutrition declarations provided to confirm their nutritional content and the suitability of declared nutrition labels for reformulation monitoring.

2. Aims and objectives

The aims of this study were to:

1. Examine the accuracy of the declared nutrition information in line with EC guideline nutrition labelling tolerances.
2. Make a recommendation on the use of declared nutrition labels for the monitoring of food reformulation of total fat, saturated fat and sugar in Ireland.

The objectives of this study were to:

1. Examine the declared nutrition labels and analyse nutrition content of energy, total fat, saturated fat and sugar in 200 yogurts sold on the Irish market from October to December 2018.
2. Examine whether declared nutrition labels were within the EC guideline nutrition labelling tolerances for total fat, saturated fat and sugar in 200 yogurts sold on the Irish market from October to December 2018, and to see whether there was any systematic bias to those declarations.
3. Make a recommendation on the use of declared nutrition labels for monitoring food reformulation of, total fat, saturated fat and sugar in Ireland.
4. Contribute to establishing a baseline for energy, total fat, saturated fat and sugar (including lactose) in yogurts sold on the Irish market in 2018 that could be used to monitor reductions against food reformulation targets to be set for Ireland.

3. Methodology

3.1 Sample selection, categorisation and collection

The product list from the Irish market scan of yogurts (including yogurt alternatives) undertaken by the FSAI in 2016 was used as the sampling frame (n=578) for this study. Yogurts identified in the 2016 market scan (n=578) were weighted, using probability proportion to size, based on product category (natural, flavoured and luxury) and manufacturer type (branded, own brand), both as assigned in the 2016 study (see Figure 1). Yogurts (n=200) were randomly selected from the weighted groups to produce a list to include in this study. Yogurts were collected from the Irish market, both from in-store and online retailers, between October and December 2018 by a third party. Where a product from the 2016 sampling frame was no longer available on the Irish market, a replacement product was sampled which was of the same category and manufacturer type and within 1.5 g of the declared nutrient content of the original sample.

Branded=62.5% (**n=125 samples)** and own brand=37.5% (**n=75 samples)**

**Not possible to determine if 1 Natural and 2 Flavoured yogurts were branded or own brand*

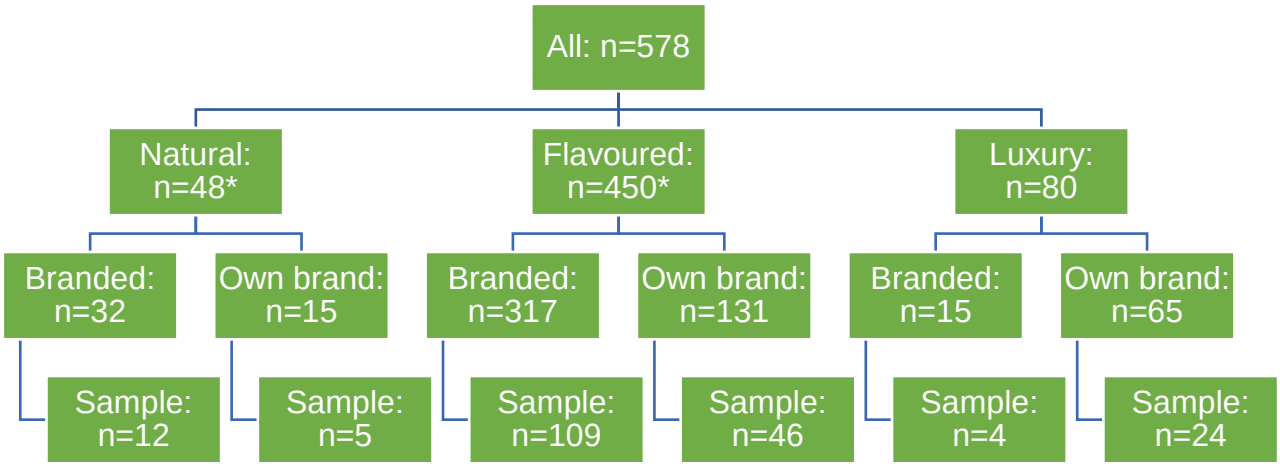

Figure 1 Yogurt sample weighting

3.2 Laboratory analysis of yogurts

An Irish private accredited laboratory was contracted to analyse the samples for total fat, saturated fat and sugar content. The analysis of total sugar was subcontracted to an accredited laboratory in the United Kingdom (UK). Details of the analytical methods used are outlined in Annex 1. Data were submitted to the FSAI in Microsoft Excel documents and as hard-copy reports.

3.3 Data and statistical analysis

Data were analysed using Microsoft Excel and IBM Statistical Package for Social Sciences (SPSS) (Version 25). As data were not normally distributed, median values were investigated for declared and tested energy, total fat, saturated fat and sugar content using the Wilcoxon Signed-Rank test and the Spearman Rank-Order Correlation.

To perform statistical analysis, samples with a nutrient below the level of detection (defined as trace) were coded as containing 0g of that nutrient. One sample was removed from statistical analysis, as it was a significant outlier in terms of total fat and saturated fat content and skewed the data.

EC guideline nutrition labelling tolerances were calculated by setting the initial bounds, applying the tolerance permitted for the nutrient type and amount (giving consideration to whether or not a claim was made on the food) and finally, applying the rounding principal as set out in Section 6 of the guidance document.

3.4 Study limitations

The study had the following limitations:

1. Due to budgetary restrictions, the study used one sample per product to measure the nutritional content, rather than a number of samples from different batches of the same product. Using a number of samples from different batches of the same product would have increased the reliability of the analysed values for each product and more accurately reflected the average nutrient value as declared on the label.
2. The 2016 market scan identified all yogurts on the Irish market and was therefore considered representative of the market at that time. However, by 2018 (when samples were taken for this study), some products were no longer available and were swapped for similar products or flavours. These swaps could have affected the overall market representativeness of samples in this 2018 study. However, as this study examined the accuracy of the label nutrition content of yogurts sampled, this would not have affected the overall outcome of the study.

4 Results

4.1 Description of samples

A breakdown of study samples by product category and manufacturer type is presented in Figure 2.

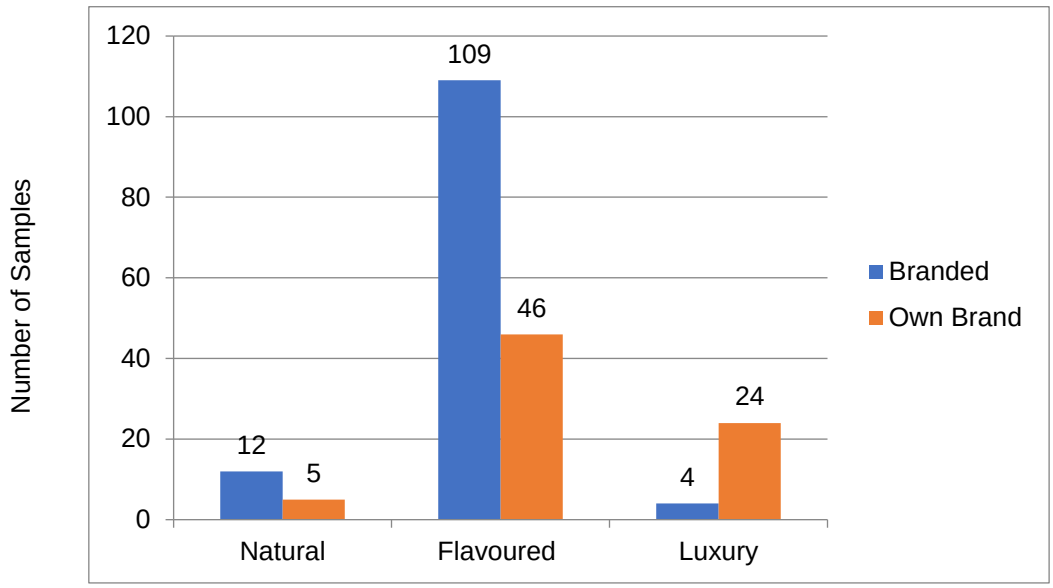

Figure 2 Number of yogurts selected disaggregated by product category and manufacturer type

Due to changes in the market since the 2016 cross-sectional market scan, 23 product swaps and 35 flavour swaps were made to the samples selected. The study observed a shift from 'low-fat' yogurts to 'Greek-style' yogurts and from sweet flavours (such as chocolate) to vanilla and fruit flavours. A breakdown of the final samples included in the study by product type and category is presented in Figure 3.

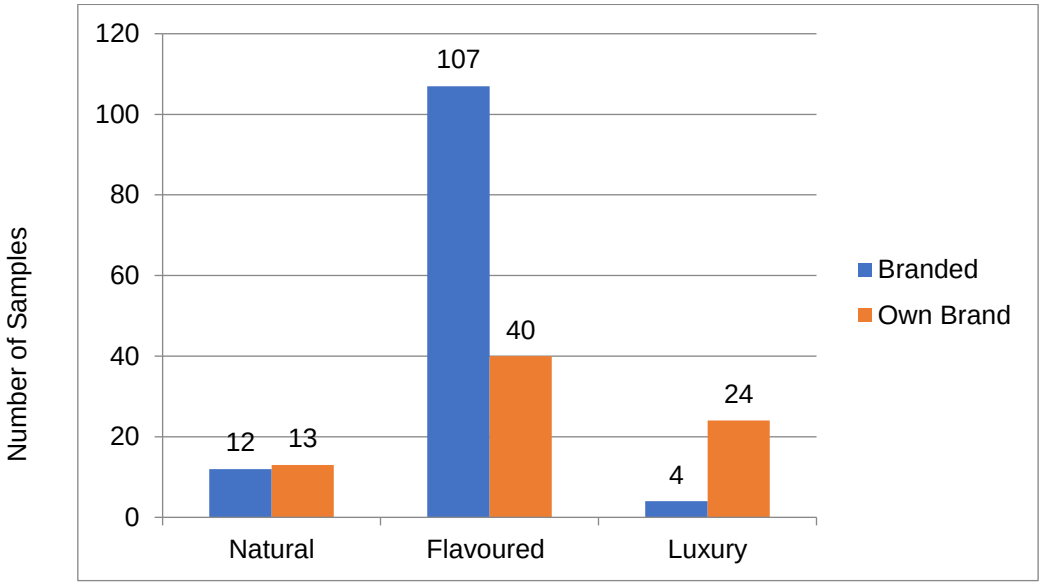

Figure 3 Number of yogurts disaggregated by product category and manufacturer type

As the application of EC guideline nutrition labelling tolerances is dependent on whether a food makes a nutrition or health claim, yogurt labels were reviewed for nutrition and/or health claims made in relation to fat, saturated fat and sugar. The study found that 42% (n=83) made nutrition claims in relation to fat and 5% (n=10) made nutrition claims in relation to sugar. None of the products made nutrition or health claims in relation to saturated fat.

A comparison of the declared and analysed content of energy, total fat, saturated fat and sugar content of 199 samples is investigated in the following section.

4.2 Comparison of declared and analysed energy content of yogurts

4.2.1 Comparison by all yogurts and by yogurt category

A comparison between the declared and analysed median energy content of all yogurts and by yogurt category found a statistically significant difference in the declared and analysed energy content in all yogurts (p=0.029), and in the flavoured yogurts category (p=0.015). The declared median energy content of all yogurts was higher than the analysed median energy content. In the flavoured yogurts category, the analysed median energy content was higher than the declared median energy content. This is outlined in Table 1.

Table 1 A comparison of declared and analysed energy content of all yogurts and by yogurt category

Yogurt category	Source of nutrition information	Median energy content (kcal per 100 g)	Minimum and maximum energy content (kcal per 100 g)	Statistical significance (Wilcoxon signed-rank test)
All categories (n=199)	Declared	87	37–209	p=0.029
	Analysed	84	12–221	
Natural (n=25)	Declared	67	37–132	NS*
	Analysed	68	46–136	
Flavoured (n=146)	Declared	82	44–189	p=0.015
	Analysed	85	12–187	
Luxury (n=28)	Declared	149	87–209	NS*
	Analysed	142	87–221	

*NS=not statistically significant

4.2.2 Comparison by manufacturer type

A comparison between the declared and analysed median energy content of yogurts by manufacturer type found branded yogurts had a declared median energy content that was statistically lower than the analysed median energy content (p=0.022). This is outlined in Table 2.

Table 2 A comparison of declared and analysed energy content of yogurts by manufacturer type

Manufacturer type	Source of nutrition information	Median energy content (kcal per 100 g)	Minimum and maximum energy content (kcal per 100 g)	Statistical significance (Wilcoxon signed-rank test)
Branded (n=123)	Declared	82	37–189	p=0.022
	Analysed	84	12–187	
Own brand (n=76)	Declared	93	45–209	NS*
	Analysed	90	46–221	

*NS=not statistically significant

4.3 Comparison of declared and analysed total fat content of yogurts

4.3.1 Comparison by all yogurts and by yogurt category

The median declared total fat content was significantly higher than the median analysed total fat content of all yogurts ($p<0.05$) and for yogurts in the luxury category ($p<0.05$). This is outlined in Table 3.

Table 3 A comparison of declared and analysed total fat content of all yogurts and by yogurt category

Yogurt category	Source of nutrition information	Median fat content (g per 100 g)	Minimum and maximum fat content (g per 100 g)	Statistical significance (using Wilcoxon signed-rank test)
All categories (n=199)	Declared	2.7	0–12	$p<0.05$
	Analysed	2.5	0–12	
Natural (n=25)	Declared	2.5	0–11	NS*
	Analysed	2.4	0–10	
Flavoured (n=146)	Declared	2.1	0–9.7	NS*
	Analysed	2.0	0–9.4	
Luxury (n=28)	Declared	7.4	1.8–11.7	$p<0.05$
	Analysed	6.5	1.3–12	

*NS=not statistically significant

4.3.2 Comparison by manufacturer type

A comparison of the declared and analysed median total fat content of all yogurts, disaggregated by manufacturer type, found a statistically significant difference (p=0.001) in 'own brand' yogurts between the median declared total fat content and the median analysed total fat content. There was a trend for the median analysed total fat content to be lower than the median declared total fat content of 'own brand yogurts'. This is outlined in Table 4.

Table 4 A comparison of declared and analysed total fat content of yogurts by manufacturer type

Manufacturer type	Source of nutrition information	Median fat content (g per 100 g)	Minimum and Maximum fat content (g per 100 g)	Statistical significance (using Wilcoxon signed-rank test)
Branded (n=123)	Declared	2.6	0–11.0	NS*
	Analysed	2.5	01–9.3	
Own brand (n=76)	Declared	2.8	0–11.7	p=0.001
	Analysed	2.5	0–12.1	

*NS=not statistically significant

4.3.3 Comparison of declared and analysed total fat content of all yogurts with EC guideline nutrition labelling tolerances

The EC guideline nutrition labelling tolerances for total fat is defined as <10 g of fat per 100 g ±1.5g, and 10–40 g of fat per 100 g ±20% for foods without a nutrition or health claim, and is dependent on condition of use for foods with a nutrition or health claim. Of all analysed yogurts, 93% (n=187) were within the EC guideline nutrition labelling tolerances for total fat, meaning that 7% (n=13) of analysed yogurts were outside the EC guideline nutrition labelling tolerances for total fat; 77% (n=10) of the yogurts that were outside labelling tolerances for fat had a higher fat content than was declared on the label. The trend in label tolerances for total fat is outlined in Figure 4.

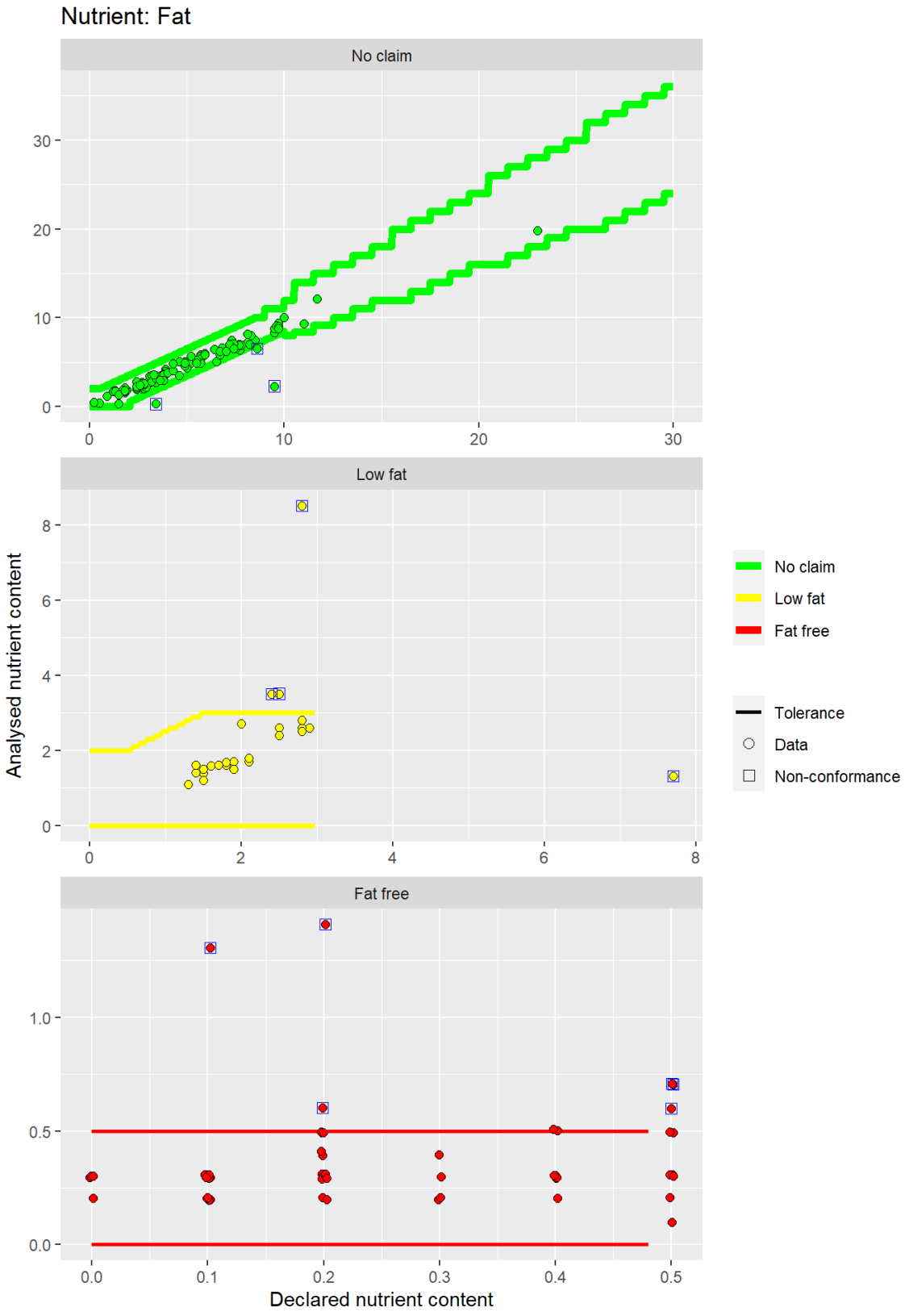

Figure 4 Trend in total fat nutrition labelling tolerances for all yogurts

4.4 Comparison of declared and analysed saturated fat content of yogurts

4.4.1 Comparison by all yogurts and by yogurt category

A comparison of the median declared and analysed saturated fat content of all yogurts and by yogurt category found no statistically significant difference in the median values of declared and analysed saturated fat content. This is outlined in Table 5.

Table 5 A comparison of declared and analysed saturated fat content of all yogurts and by yogurt category

Yogurt category	Source of nutrition information	Median saturated fat content (g per 100 g)	Minimum and maximum saturated fat content (g per 100 g)	Statistical significance (using Wilcoxon signed-rank test)
All categories (n=199)	Declared	0.7	0.0–11.7	NS*
	Analysed	1.5	0.1–8.1	
Natural (n=25)	Declared	1.6	0.0–7.6	NS*
	Analysed	1.6	0.1–6.7	
Flavoured (n=146)	Declared	1.4	0.0–9.1	NS*
	Analysed	1.1	0.1–8.1	
Luxury (n=28)	Declared	4.6	1.1–7.5	NS*
	Analysed	4.2	0.7–8.1	

*NS=not statistically significant

4.4.2 Comparison by manufacturer type

A comparison of median declared and analysed saturated fat content of yogurts, disaggregated by manufacturer type, found a statistically significant difference (p=0.017) in 'own brand' yogurts for median saturated fat content. There was a trend for median analysed saturated fat content to be lower than the median declared saturated fat content of 'own brand' yogurts. This is outlined in Table 6.

Table 6 A comparison of declared and analysed saturated fat content of yogurts by manufacturer type

Manufacturer type	Source of nutrition information	Median saturated fat content (g per 100 g)	Minimum and maximum saturated fat content (g per 100 g)	Statistical significance (using Wilcoxon signed-rank test)
Branded (n=123)	Declared	1.7	0.0–9.1	NS*
	Analysed	1.4	0.1–8.1	
Own brand (n=76)	Declared	1.9	0.0–7.6	p=0.017
	Analysed	1.6	0.1–8.1	

*NS=not statistically significant

4.4.3 Comparison of declared and analysed saturated fat content of all yogurts with EC guideline nutrition labelling tolerances

The EC guideline nutrition labelling tolerances for saturated fat are defined as <4 g of saturated fat per 100 g ±0.8 g, and >4 g per 100 g ±20% for foods without a nutrition or health claim, and is dependent on condition of use for foods with a nutrition or health claim. Of all yogurts analysed, 95% (n=190) were within the EC guideline nutrition labelling tolerances for saturated fat, meaning that 5% (n=9) of yogurts were outside of the EC guideline nutrition labelling tolerances for saturated fat. The trend in nutrition labelling tolerances for saturated fat is outlined in Figure 5. As observed with total fat, there is a tendency for yogurts with a saturated fat content outside of EC guideline nutrition labelling tolerances to contain less saturated fat when analysed than that declared on the label.

Figure 5 Trend in saturated fat nutrition labelling tolerances for all yogurts

4.5 Comparison of declared and analysed sugar content of yogurts

4.5.1 Comparison by all yogurts and by yogurt category

A comparison of the median declared and analysed sugar content by all yogurts and by yogurt category found that there was a statistically significant difference in the median declared and median analysed sugar content in all yogurts, and in each yogurt category. There was a trend across all yogurts and in each yogurt category for median declared sugar content to be significantly higher than median analysed sugar content. This is outlined in Table 7.

Table 7 A comparison of declared and analysed sugar content of all yogurts and by yogurt category

Yogurt category	Source of nutrition information	Median sugar content (g per 100 g)	Minimum and maximum sugar content (g per 100 g)	Statistical significance (using Wilcoxon signed-rank test)
All categories (n=199)	Declared	9.9	2.2–22.8	*p*=<0.05
	Analysed	8.7	1.9–21.5	
Natural (n=25)	Declared	4.8	3.2–7.5	*p*=<0.05
	Analysed	3.4	1.9–5.6	
Flavoured (n=146)	Declared	9.7	2.2–18.4	*p*=<0.05
	Analysed	8.6	2.3–17.3	
Luxury (n=28)	Declared	15.0	10.0–22.8	*p*=0.002
	Analysed	13.6	8.6–21.5	

4.5.2 Comparison by manufacturer type

A comparison of median declared and analysed sugar content of yogurts, disaggregated by manufacturer type, found a statistically significant difference between the median declared and median analysed sugar content in both the ‘branded’ and ‘own brand’ yogurt types. There was a trend for median analysed sugar content to be lower than median declared sugar content. This is outlined in Table 8.

Table 8 A comparison of declared and analysed sugar content of yogurts by manufacturer type

Manufacturer type	Source of nutrition information	Median sugar content (g per 100 g)	Minimum and maximum sugar content (g per 100 g)	Statistical significance (Wilcoxon signed-rank test)
Branded (n=123)	Declared	8.1	2.2–21.3	$p<0.05$
	Analysed	7.2	2.0–21.5	
Own brand (n=76)	Declared	11.1	3.2–22.8	$p<0.05$
	Analysed	10.3	1.9–17.5	

4.5.3 Comparison of declared and analysed sugar content of all yogurts with EC guideline nutrition labelling tolerances

The EC guideline nutrition labelling tolerances for sugar are defined as <10 g of sugar per 100 g ±2 g, and 10–40 g per 100 g ±20% for foods without a nutrition or health claim, and is dependent on condition of use for foods with a nutrition or health claim. Of all yogurts analysed, 83% (n=167) were within the EC guideline nutrition labelling tolerances for sugar, meaning that 17% (n=33) of yogurts analysed were outside of the EC guideline nutrition labelling tolerances for sugar. The trend in nutrition labelling tolerances for sugar is outlined in Figure 6. It was observed that there is a tendency for yogurts to have a lower analysed sugar content than that declared on the label.

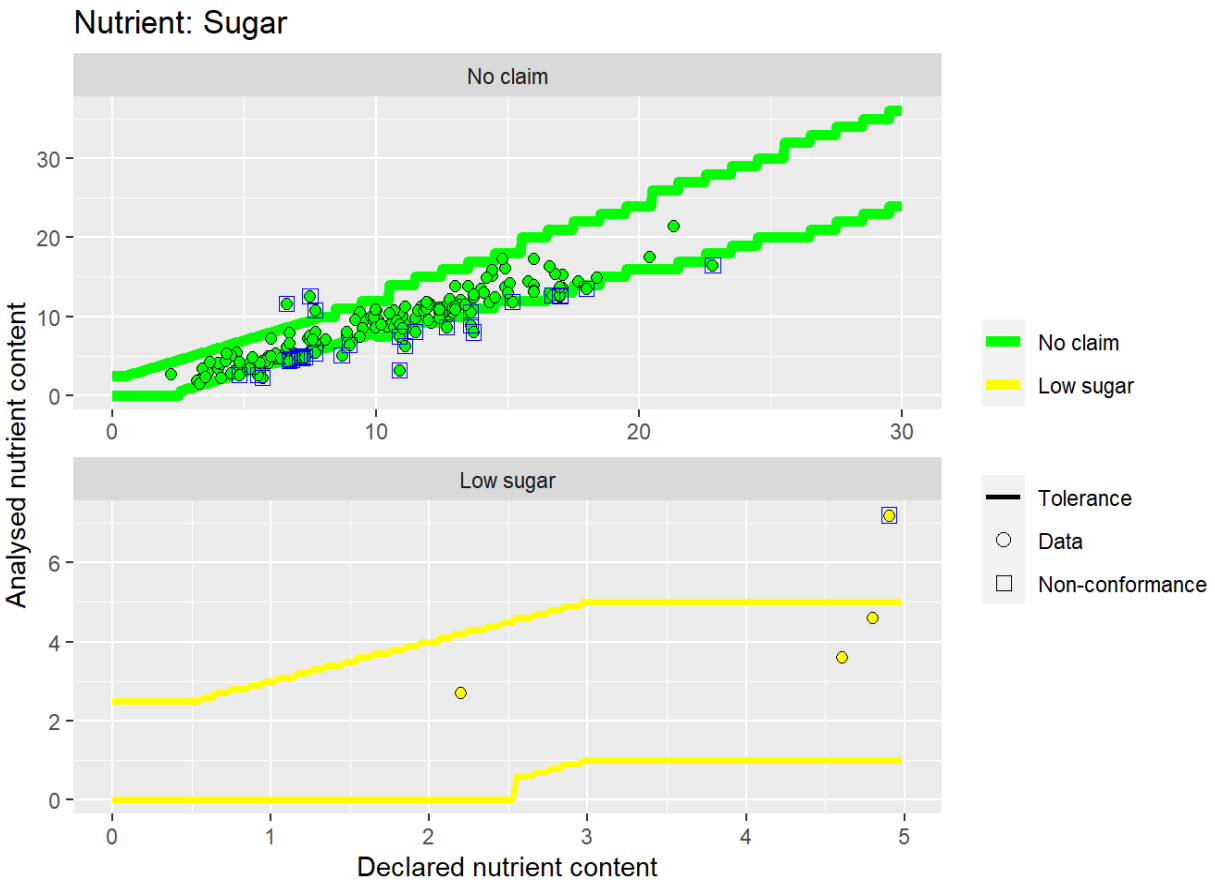

Figure 6 Trend in sugar nutrition labelling tolerances for all yogurts

4.5.4 Analysed lactose content of dairy based yogurts on the Irish market

The lactose content of dairy based yogurts (n=191) was analysed in order to establish a baseline for the natural sugar content of dairy based yogurts on the Irish market that could be used for reformulation monitoring. Natural yogurts (n=25) contained 0.0–5.6 g of lactose per 100 g. There was no statistically significant difference between lactose content of branded and own-brand dairy based yogurts. The natural sugar content of all dairy based yogurts and by yogurt category is outlined in Table 9.

Table 9 Analysed lactose content of dairy based yogurts and by yogurt category

Yogurt category	Source of nutrition information	Median lactose content (g per 100 g)	Minimum and maximum lactose content (g per 100 g)
All categories (n=191)	Analysed	3.3	0.0–5.6
Natural (n=25)	Analysed	3.4	0.0–5.6
Flavoured (n=138)	Analysed	3.3	0.0–5.1
Luxury (n=28)	Analysed	3.3	1.8–5

4.5.5 Analysed sucrose content of yogurts on the Irish market

The sucrose content of all yogurts was analysed in order to indicate the added sugar content of yogurts on the Irish market. Yogurts contained between 0-13.1 g of sucrose per 100 g. The sucrose content of all yogurts, and by yogurt category, is outlined in Table 10.

Table 10 Analysed sucrose content of all yogurts and by yogurt category

Yogurt category	Source of nutrition information	Median sucrose content (g per 100 g)	Minimum and maximum sucrose content (g per 100 g)
All categories (n=199)	Analysed	3.0	0.0–13.1
Natural (n=25)	Analysed	0.0	0.0–0.0
Flavoured (n=146)	Analysed	2.9	0.0–11.6
Luxury (n=28)	Analysed	5.3	3.0–13.1

Table 11 outlines the sucrose content in branded and own brand yogurts.

Table 11 Sucrose content of analysed yogurts disaggregated by manufacturer type

Manufacturer type	Source of nutrition information	Median sucrose content (g per 100 g)	Minimum and maximum sucrose content (g per 100 g)
Branded (n=123)	Analysed	2.3	0.0–10.3
Own brand (n=76)	Analysed	3.6	0.0–13.1

4.6 Portion size

Recommended portion size was stated on each product. The median recommended portion size was 125 g (range: 25–190 g). The median portion size for own-brand yogurts (130 g) was higher than for branded products (120 g). The median portion size was highest for luxury yogurts (150 g), followed by flavoured (125 g) and natural (100 g) yogurts. Energy content and portion size was investigated using the Spearman rank-order correlation coefficient. There was a small positive correlation between the two variables ($r=0.27$, $p<0.001$).

5. Discussion

The aims of this study were to examine the accuracy of the declared nutrition labels of a sample of yogurts sold on the Irish market between October and December 2018 in line with EC guideline nutrition labelling tolerances, and to make a recommendation on the use of declared nutrition labels for the monitoring of food reformulation of total fat, saturated fat and sugar in Ireland.

5.1 Overview of yogurt market and observed trends

The study observed a diversity in the types of yogurts available on the Irish market that differ widely in their nutritional content. The study noted that luxury yogurts tended to be high in sugar and total fat. Natural yogurts tended to have lower sugar content, and flavoured yogurts had lower total fat content than luxury yogurts. Across the three yogurt categories, there was large variation in the sugar and total fat content.

The findings of this study indicate that the yogurt market in Ireland is rapidly changing. Over the 2-year period between the FSAI market scan in 2016 (which was used as the study sampling frame) and the sampling for this study in 2018, 12% of yogurts were no longer available and 17% of yogurts were available but in a different flavour. The study observed a shift from perceived artificial flavours, such as toffee and chocolate, to flavours such as fruit and vanilla. The study found an increase in the availability of own-brand natural yogurts and a small decrease in the availability of yogurts in the luxury and flavoured categories. It was also observed that there was a move away from yogurts labelled as ‘low fat’ and an increase in yogurts labelled as ‘Greek style’. The demand for ‘Greek-style’ yogurt may reflect an increasing demand from the consumer for perceived ‘healthier’ options (Asioli et al., 2017). The study found that despite these changes, there remain yogurts on the market which are high in sugar and total fat.

5.2 Comparability of declared and analysed nutrition content

The study observed a tendency for median declared total fat, saturated fat and sugar content to be higher than median analysed content.

When the EC guideline nutrition labelling tolerances were applied, the difference in declared and analysed total fat and saturated fat was minimal. However, it was observed that this was not the case for sugar, for which 17% (n=33) of yogurts were outside the EC guideline nutrition labelling tolerances.

In total, 45 yogurts (23%) were found to be outside the EC guideline nutrition labelling tolerances, 9 of which were outside EC guideline nutrition labelling tolerances for two or more nutrients. Analysed nutrient content was lower than was stated on the label in 71% (n=39) of non-conformances with EC guideline nutrition labelling tolerances. While this is a potential non-conformance with labelling guidance, it is one that favours the consumer in terms of a healthier nutrient profile for yogurts on the market. However, analysed fat content was systematically higher, with 77% (n=10) of the yogurts that were outside labelling tolerances for fat measuring higher fat content than declared. In the majority of cases this was as a result of the fat content being above the maximum amount set for ‘low fat’ and ‘fat free’ claims.

Other studies have found high levels of non-conformance with labelling tolerances. A study undertaken in Australia found that when a broad stroke tolerance of ±20% was applied to all declared nutrients on 350 samples of 70 different food products, 30% would not be compliant (Fabiansson, 2006). Similarly, a study in Malaysia found that 73% of 300 samples made up of a range of food categories were non-conformance with a labelling tolerance of ±20% (Kok and Mohamed Radzi, 2017).

5.3 The use of declared nutrition labels for reformulation monitoring

The introduction in 2016 of mandatory nutrition declaration of energy, total fat, saturated fat, carbohydrate, sugars, protein and salt of pre-packaged food per 100 g, under Regulation (EU) No 1169/2011 has led to the use of declared nutrition labels for monitoring food reformulation in Europe. This is a cost-effective way to monitor reformulation of foods. However, the findings of this study indicate that when EC guideline nutrition labelling tolerances are applied, it is possible that declared nutrition labels may not reflect the true food reformulation efforts. The International Network for Food and Obesity/Non-communicable Diseases (NCDs) Research, Monitoring and Action Support (INFORMAS) network recommends, where resources allow, the validation of declared nutrition information on food labels of food products surveyed in the monitoring of important nutrients in the food supply (Neal et al., 2013).

6. Conclusion and recommendations

This study found that the median analysed total fat and sugar content were significantly different than the amounts declared on labels in yogurts sampled from the Irish market. Declared nutrition information on product labels was mostly in line with EC guideline nutrition labelling tolerances for total fat and saturated fat content of yogurts. However, 17% (n=33) of analysed yogurts were outside EC guideline nutrition labelling tolerances for sugar. In the case of sugar and saturated fat, the study observed no systematic bias for placing yogurts on the market with higher nutrient content than labelled. However, analysed fat content was higher, with 77% (n=10) of yogurts outside labelling tolerances for fat, measuring higher fat content than declared. The findings of this study indicate that declared nutrition information on food labels may not reflect the true food reformulation efforts of foods sold in the Irish retail food environment.

Based on the findings of this study, the following recommendations are made:

- When EC guideline nutrition labelling tolerances are accounted for, it is possible that declared nutrition labels may not reflect the true food reformulation efforts. This finding needs to be considered when developing a reformulation monitoring programme.
- Reformulation monitoring programmes relying on labelled nutrition information need to be ‘fact checked’ at regular intervals using a nutrition label verification method.
- Innovative food categories, such as yogurts, require regular monitoring to understand reformulation efforts in these food categories.
- There are numerous factors which influence variations in declared and analysed nutrient content of yogurts, and this requires further investigation with the food industry as it could affect reformulation monitoring.
- Additional food categories should be investigated using the same methodology in order to determine if the findings of this study apply to other food categories.

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8. Annex

8.1 Annex 1: Methods used for the determination of energy, total fat, saturated fat and sugar content of yogurts

Analysis	Method summary
Fat and moisture	This test utilises the CEM SMART Trac II™ Rapid Fat and Moisture/Solids Analyser. SMART Trac produces moisture results by removing water (evaporation) via microwave energy and measuring the weight loss on drying. The dried sample is transferred into a plastic sleeve using the Compression Station and inserted into the NMR instrument, where it then receives a pulse of radio-frequency energy from the NMR for analysis of fat content. It measures fat directly by using signal-to-mass ratio.
Fatty acid composition	Fat is extracted from a sample by microwave digestion – saponification in methanolic potassium hydroxide solution when fats are converted to free fatty acids (salts). The fatty acids are derivatised to their methyl esters by treatment with a methylation solution of sulphuric acid in methanol and then extracted with hexane. Identification and quantification of fatty acids is achieved by gas chromatography using flame ionisation detection and hydrogen as a carrier gas. Total fat content of the sample is obtained using the fat and moisture determination procedure outlined above.
Energy calculation for food	Energy is calculated in kcal and in kJ/100 g. The calculations are performed as follows: ENERGY (kcal/100 g) = (P×4) + (F×9) + (C×4) ENERGY (kJ/100 g) = (P×17) + (F×37) + (C×17)
Sugar	Sugars are determined on a hot water extract of the sample by ion chromatography with pulsed amperometric detection using a gold electrode, with calibration against an internal standard.

8.2 Annex 2: Version history and updates

Version name	Date of change	Description of change
V1	14/03/2023	Plant-based yogurts were removed from analysis of lactose content. To reflect this, updates were made to section 4.5.4 and Table 9.

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