A comparison of national dietary surveys (Scottish Health Survey 2021 and Dietary Intake in Scotland's cHildren 2024) with Worldpanel by Numerator household purchase data

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Food Standards Scotland

Inbhe Bìdh Alba

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Abbreviations

DISH	Dietary Intake in Scotland's cHildren
FSS	Food Standards Scotland
NDB	Nutrient Databank
NDNS	National Diet and Nutrition Survey
SHeS	Scottish Health Survey
WRAP	Waste and Resources Action Programme

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1. Introduction

1.1. Background

Self-reported diet surveys often rely on individuals to recall their food and drink consumption over a set time period, such as the previous day for surveys using 24-hour recalls or over a longer time period such as the previous month or year for surveys using food frequency questionnaires. Mis-reporting of energy intake is an established issue across all self-reported diet surveys, with under-reporting of energy intake generally most common.

Doubly labelled water is a method used to approximate energy expenditure as a proxy for energy intake and compare with self-reported intake in diet surveys to assess the degree of mis-reporting. Doubly labelled water cannot determine which specific foods and drinks are mis-reported, only that mis-reporting is likely.

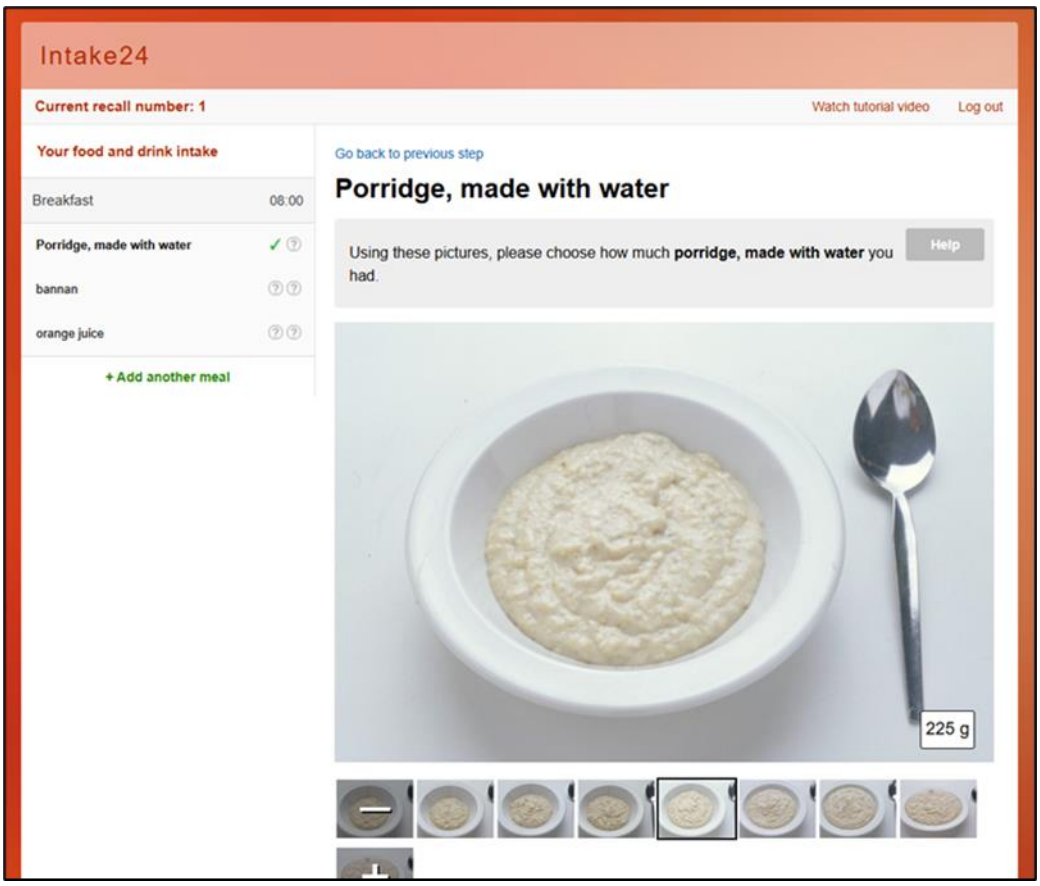
The most recent doubly labelled water sub-study of the National Diet and Nutrition Survey (NDNS, 2019/20 and 2020/22) found that energy intake reported using 24-hour recalls was, on average across all age and sex groups, about 30% lower than doubly labelled water (Office for Health Improvement and Disparities, 2025). Under-reporting was lowest for children 4 to 10 years (**Table 1**).

Table 1. Estimated percentage of energy intake under-reported by 24-hour recalls as compared to doubly labelled water in a sub-study of the National Diet and Nutrition Survey, 2019/20 and 2020/22 (Office for Health Improvement and Disparities, 2025).

Age group	Sex	Sample size	Estimated percentage of energy intake under-reported by 24-hour recalls
4-10y	Males	20	16%
4-10y	Females	21	18%
4-10y	Both	41	17%
11-15y	Males	29	31%
11-15y	Females	27	23%
11-15y	Both	56	27%
16-49y	Males	43	40%
16-49y	Females	44	31%
16-49y	Both	87	36%
50-64y	Males	24	33%
50-64y	Females	30	35%
50-64y	Both	54	34%
65+y	Males	22	34%
65+y	Females	19	30%
65+y	Both	41	33%

National dietary assessment surveys in Scotland and the rest of the UK use a software called Intake24. Intake24 is a self-administered tool based on multiple-pass 24-hour dietary recall. The software includes images to assist with portion size estimation (**Figure 1**).

Figure 1. Screenshot of Intake24, a self-administered 24-hour dietary recall software.



Studies evaluating the accuracy of Intake24 have suggested that energy intake is under-reported (Office for Health Improvement and Disparities, 2025).

Evidence to support under-reporting of energy intake also comes from national diet surveys which generally report energy intakes of 1500 to 1800 kcal/day in adults (Scottish Government, 2022b). Reported energy intake values from other surveys, namely the Worldpanel by Numerator retail purchase household survey, are higher; typically, about 2200 kcal/day. Given estimated average energy requirements for adults range between 2200 and 2800kcal/day and at least two-thirds of the population are living with overweight or obesity, the Worldpanel by Numerator value is likely closer to true intakes. However, purchase data are not without limitations as they do not account for food waste and therefore may over-estimate consumption. Moreover, purchase data are typically collected at the household level, which makes it difficult to estimate individual-level consumption.

Energy intake estimated by Intake24 is likely under-reported, potentially substantially among adults. However, it is not known which foods and/or drinks contribute to this under-reporting and whether certain food and/or drinks contribute to mis-reporting across nutrients, beyond

just energy. Addressing these gaps is important to understand the implications of mis-reporting in national surveys for estimates of nutrient intake and achievement of dietary goals.

1.2. Aims

1. To compare food group intake data from Intake24 to Worldpanel by Numerator data.
2. To qualitatively assess the implications of food and drink mis-reporting on energy intake and intake of fat, saturated fat, carbohydrates, fibre, total sugars, and sodium.
3. To make recommendations for improving reporting of dietary intake using Intake24 for future national dietary assessments.

This report does not suggest that retail purchase data should replace self-reported dietary intake data. Rather, it suggests improvements that can be made to national dietary assessment surveys in Scotland and the rest of the UK and recommends future research to understand mis-reporting.

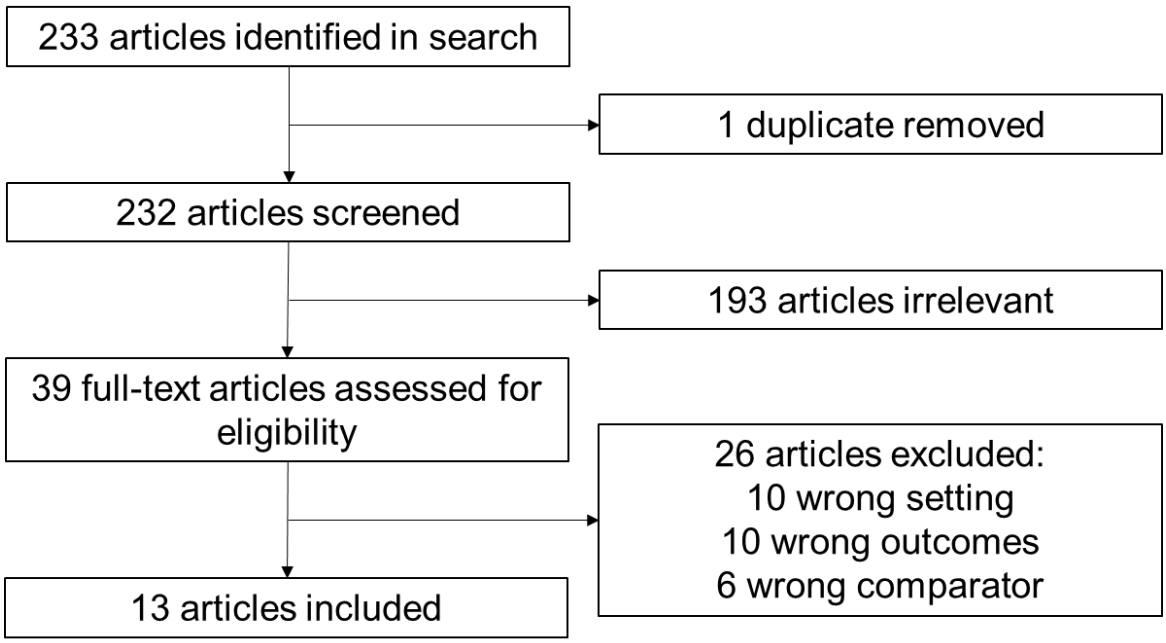
2. Review of previous studies on food and drink mis-reporting in 24-hour dietary records and recalls

2.1. Approach to reviewing the literature

Most previous studies have focused on mis-reporting of energy intake given that doubly labelled water is a well-established objective proxy for energy intake. Studies that explore which specific foods and drinks are mis-reported are scarce. To summarise recent research on mis-reporting of foods and drinks in 24-hour dietary records and recalls, we conducted a systematic review of published literature.

We searched one database (PubMed) on 25 March 2025 for studies published in English in the past 10 years. The following search terms were used: ("accuracy" or "misreport*") AND "diet* assessment" AND ("nutrient" or "food" or "beverage" or "drink"). We verified that this search picked up an article we knew from our previous work had assessed mis-reporting of specific foods and drinks (Garden et al., 2018). **Figure 2** shows the PRISMA flow diagram for the review.

Figure 2. PRISMA flow diagram for review of studies on food and drink mis-reporting in 24-hour dietary records and recalls.



The PubMed search identified 233 articles which were imported into Covidence software for removal of duplicates (n=1) and screening by one author (RU). Thirty-nine full texts were then screened by two authors (GM and LJ). Original articles that assessed mis-reporting of specific foods and drinks or food and drink groups in 24-hour dietary records or recalls were included. Articles that only assessed mis-reporting of energy intake or nutrients (e.g., protein, potassium and sodium, which, like energy, have recovery biomarkers) were excluded. Studies conducted

outside Europe, Canada, the United States, Australia and New Zealand were excluded. These included four studies in China, two studies in Ethiopia, and one study each in Brazil, Cambodia, Chile, Kuwait, Malaysia, Republic of Korea, Solomon Islands, Vietnam, and Zambia. Inpatient studies of specific population groups such as individuals with eating disorders were excluded. Commentaries, study protocols and two systematic reviews (Whitton et al., 2022; Zhang et al., 2021) were excluded.

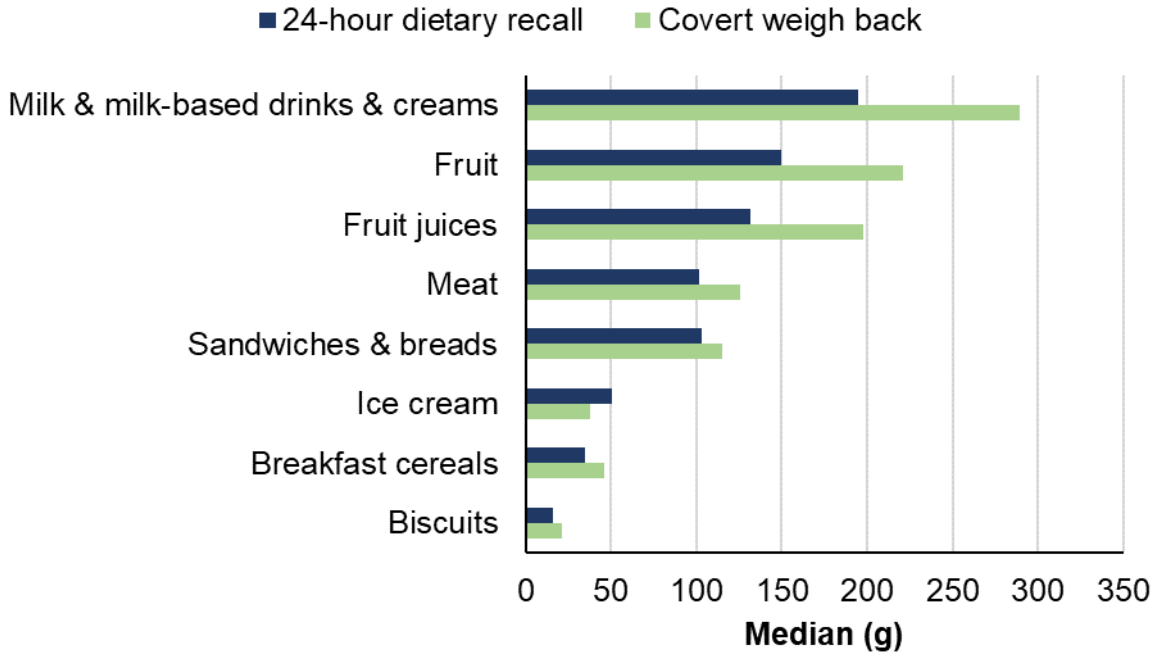
Thirteen articles from 12 studies met eligibility criteria. Extracted data are presented in **Annexe 1**.

2.2. Summary of food and drink mis-reporting in previous dietary surveys

Controlled feeding studies are one approach to measuring the mis-reporting of specific foods and drinks. These studies assess “true intake” by directly weighing the items served and any leftovers. Self-reported dietary intake—whether that be macro- or micro-nutrient intake, or intake of specific foods and drinks—can then be objectively compared to “true intake.” Whilst the generalisability of these studies may be limited due to their small sample size and highly controlled (versus “real world”) environment, they offer clues regarding what aspects of diet are more or less likely to be mis-reported. Moreover, controlled feeding studies mirror the experience of eating out of home, where participants have limited knowledge about the preparation of their meals. Thus, these studies also allow us to assess the accuracy of self-reporting premade meals (e.g., out of home), which are widely consumed across Scotland.

The systematic review identified four controlled feeding studies, one conducted in Scotland and three conducted in the United States. The study conducted in Scotland (Aberdeenshire) involved 59 participants living in a controlled study facility for 12 days and covertly assessed dietary intake and compared it to what participants self-reported consuming (Garden et al., 2018). They found that milk and milk-based drinks and creams were underestimated by, on average, 28%, and fruit by, on average, 25% (**Figure 3**).

Figure 3. Comparison of median (g) measured and reported intake of food groups that statistically significantly differed in a study in Aberdeenshire involving 59 participants living in a controlled study facility for 12 days (data are extracted from Table 2 of Garden et al., 2018).



The two studies in the United States were not residential studies (i.e., participants did not live in a study facility). Instead, in one of the studies, meals were created at a metabolic kitchen and picked up by participants twice per week over a 24-day period (Casey et al., 2023). Participants were told to return any uneaten food to the lab on the next visit; however, this was rarely done. Comparing the meals provided to 24-hour dietary recalls completed over the same period, researchers found that beef, lean poultry, full-fat cheese, reduced-fat cheese, low-fat yoghurt, reduced-fat margarine, and pasta were over-reported. In contrast, lean beef, butter, fat-free yoghurt, reduced fat/fat-free salad dressing, non-citrus fruit, and dark-green vegetables were under-reported.

In the second US-based controlled feeding study, participants selected and consumed foods from a buffet for breakfast, lunch and dinner over the course of one day (Kirkpatrick et al., 2019, 2022).[1] Direct observation of the three meals was compared to a web-based self-administered 24-hour dietary recall completed either independently or with assistance from a nutritionist if needed. Researchers found that meat and single-unit foods tended to be under-reported (e.g., apples, bagels, single-serve bags of crisps). In contrast, amorphous/soft foods (e.g., cereal, lasagne) and small pieces (e.g., vegetables in a salad) tended to be over-reported. The most common exclusions were additions or ingredients, such as tomatoes, cucumber, or cheese that were part of a salad or sandwich. These items accounted for an average of 43-46 kcal per person.

Similarly, in the third US-based controlled feeding study, meals were created by a metabolic kitchen: a morning meal, a midday meal, an afternoon snack, and an evening meal (Widaman

[1] Two articles were published presenting results from the same study.

et al., 2017). The morning meal, midday meal, and afternoon snack were consumed at the research centre and the dinner meal was packaged and sent home. Leftovers from the dinner meal were returned to the centre using provided containers. Researchers found that nuts/seeds, animal protein, dairy, and vegetables were over-reported in a web-based self-administered 24-hour dietary recall as compared to direct observation. The over-reporting of dairy and vegetables was hypothesised to be related to the amorphous nature of these foods (e.g., shredded cheese or a scoop of broccoli), consistent with what was observed in the study by Kilpatrick et al. (Kirkpatrick et al., 2019, 2022).

Five of the remaining eight studies involved the direct observation of school meals: one study each in Denmark, Portugal, and Serbia, and two studies in Canada (Biltoft-Jensen et al., 2015; Carvalho et al., 2015; Raffoul et al., 2019; Šumonja & Jevtić, 2016; Wallace et al., 2018). Results were not consistent across studies. For example, three studies found that milk and milk products were over-reported whereas one study found milk was under-reported. One study found that most other food groups were under-reported (e.g., fruit, protein foods, beverages, vegetables, and sweets) whereas another study found most foods were over-estimated (e.g., milk, rice, and salmon). Thus, consistent conclusions could not be drawn across these five studies comparing observed school meals to self-reported school meals.

The remaining three studies involved comparisons of self-administered 24-hour dietary recalls to interviewer-administered 24-hour dietary recalls or a 2-hour recall smartphone app, and thus provided less objective evidence of mis-reporting because both approaches relied on participant recall and self-report (Bennett et al., 2025; Lucassen et al., 2023; Söderström et al., 2024). The study in pregnant women in Sweden found no difference in reported intake of food groups between self- and interviewer-administered 24-hour dietary recalls (Söderström et al., 2024). The study in Ireland found ‘nuts, herbs and seeds’ (32% difference) and ‘potatoes and potatoes dishes (12% difference) were over-reported in self- versus interviewer-administered recalls, whereas ‘vegetables and vegetable dishes’ (10% difference) and ‘creams, ice creams and desserts’ (28% difference) were under-reported in self- versus interviewer-administered recalls (Bennett et al., 2025). In the study in The Netherlands, the 24-hour dietary recalls tended to over-estimate ‘alcoholic beverages’ and ‘grains and cereals’, and under-estimate ‘non-alcoholic beverages’ and ‘nuts, seeds, and snacks’ compared to the 2-hour recall app (Lucassen et al., 2023).

3. Approach to comparing national surveys using Intake24 to Worldpanel by Numerator data

3.1. Scottish Health Survey and Dietary Intake in Scotland's cHildren

The Scottish Health Survey (SHeS) is a representative survey of the health of the Scottish population. All adults (16+y) in SHeS 2021 were invited to complete up to two 24-hour recalls using Intake24. Of the 6,157 individuals in SHeS, 4,557 were aged 16+ years, of which 3,447 (unweighted 76%) completed at least one 24-hour recall. The majority (unweighted 85%) of this sample completed two recalls, with the remaining individuals completing one.

SHeS 2021 data collection began in April 2021 and finished by the beginning of 2022. The second phase of data collection began at the end of October 2021, after COVID-19 restrictions had been lifted. However, changes to dietary patterns during this time have been recorded, with a recent report from Food Standards Scotland (FSS) indicating that out of home purchases had a 30% decrease in 2021 compared to pre-pandemic year 2019 (FSS, 2022).

The Dietary Intake in Scotland's cHildren (DISH) survey is a representative survey of dietary intakes of children and young people aged 2 to 15 years living in Scotland in 2024. Participants were invited to complete up to four 24-hour dietary recalls using Intake24. Diets were reported by parents/guardians for children in pre-school or primary school. Children in secondary school had the opportunity to report their own diets, and a majority (unweighted 61%) of them did so. The final sample was 1,700 children and young people. Most (unweighted 84%) participants completed two or more recalls; 32% (unweighted) completed four recalls.

The SHeS and DISH sample weights were re-scaled to allow for a combined analysis following guidance from NDNS (UK Data Archive Study (2020)):

1. Divide each weight variable by its sum (i.e., the sum of the weights; 1689 for DISH and 3447 for SHeS)
2. Multiply weight variable by the combined sum of the weights from DISH and SHeS (5136)
3. Multiply the DISH weight by 1/2 (1 out of 2 surveys) and SHeS weight by 1/2 (1 out of 2 surveys)

Characteristics of the combined SHeS and DISH sample used in this analysis are presented in **Table 2**.

Table 2. Characteristics of combined Scottish Health Survey (2021) and Dietary Intake in Scotland's cHildren (2024) Intake24 dataset.

Characteristic	N = 5,136[1]
Age, years	29 (24) (2 - 95)
Age and sex group	
Female, 2-4y	4.6% (187)
Female, 5-10y	9.5% (309)
Female, 11-15y	10% (319)
Female, 16-24y	2.8% (104)
Female, 25-34y	4.2% (250)
Female, 35-44y	3.9% (304)
Female, 45-54y	4.3% (366)
Female, 55-64y	4.4% (438)
Female, 65-74y	3.4% (419)
Female, 75y+	2.9% (153)
Male, 2-4y	5.2% (225)
Male, 5-10y	12% (388)
Male, 11-15y	8.1% (261)
Male, 16-24y	2.9% (73)
Male, 25-34y	4.1% (143)
Male, 35-44y	3.7% (192)
Male, 45-54y	4.0% (229)
Male, 55-64y	4.1% (330)
Male, 65-74y	3.1% (304)
Male, 75y+	2.1% (142)

[1]Values are weighted mean (SD) (range) or weighted percentage (unweighted sample size).

3.2. Worldpanel by Numerator Take Home Panel

The Worldpanel by Numerator Take Home Panel comprises 30,000 households across Great Britain, selected to reflect national demographics and regional distribution. Key sample controls include region, household size, presence of children, and age of the main shopper, with socio-economic group accounted for through data weighting.

The panel continuously collects data on all food and drink purchases brought into the home, including supermarket deliveries and click-and-collect orders. Takeaway and out-of-home consumption are excluded. The designated main shopper scans product barcodes using provided scanners, and submits till receipts for price verification. Non-barcoded items are recorded using a codebook. Online purchases are included, with guidance provided for reporting items from delivery aggregators.

Panel data is monitored for consistency, with significant changes in household purchasing investigated and records updated accordingly. Compliance is assessed every four weeks, and data from non-compliant households is excluded. Trends are validated by manufacturers and retailers using third-party datasets.

Data is weighted to reflect the GB population. Promotional activity is tracked through panellist input and receipt analysis, supported by store visits and retailer engagement. Nutritional data is collected separately via fieldwork, web scraping, and third-party sources, covering key nutrients and linked to product barcodes. Where direct data are not available, nutritional values are imputed. Nutrient volumes are weighted alongside purchase data to represent national consumption, with seasonal fieldwork capturing new products and checks in place to ensure data accuracy.

The data used in this report are a subset of the Worldpanel by Numerator Take Home Panel, and therefore some data that is available at higher granularity in the full dataset are not available for comparisons within this report. Going forward, references to Worldpanel by Numerator refer to the subset of data provided to FSS, titled, “Worldpanel FSS Subset”.

3.3. Food Groups

We were only able to compare nutrients from specific food groups (**Table 3** and **Annexe 2**) because we were not able to derive some of the Worldpanel FSS Subset food groups from the SHeS/DISH data. For example, Worldpanel FSS Subset includes a food group called, ‘Canned goods’. Intake24 does not include sufficient detail for all reported items to determine whether it was canned or not. In order to compare food groups, we matched Worldpanel FSS Subset categories and Intake24 sub food groups to a new comparison food group. In some cases, we used string matching of item descriptions in Intake24 where the sub food group contained mixed items. For example, ‘EGG PRODUCTS – MANUFACTURED’ is a sub food group in Intake24, but contains mixed dishes which would not readily compare to ‘Eggs’ in Worldpanel FSS Subset. We therefore selected only the items from the egg sub food groups that are single item eggs excluding butter or oil, e.g., ‘Omelette, plain’ was included but ‘Omelette with ham & cheese’ was excluded.

Comparison food groups were classified as ‘high’, ‘medium’, or ‘low’ confidence for comparison. Those classified as ‘high’ were largely like-for-like comparisons. Many of these food groups were alcoholic and non-alcoholic beverages. Those classified as ‘medium’ had small caveats, for example, for ‘Eggs’, Intake24 includes nutrients from cooking such as ‘Egg, fried in butter’; and for ‘Soft drinks’, Intake24 includes all fruit juice whereas Worldpanel FSS Subset only includes ambient fruit juice. Those classified as ‘low’ had larger caveats, for example, ‘Pizza and bases’ does not include frozen pizza in Worldpanel FSS Subset.

Table 3. Comparison food groups by level of confidence

Level	Comparison Food Group	Considerations
High	Wine	
High	Spirits	
High	Beer+Lager	
High	Cider	
High	Non Alcoholic Beer	
High	Milk	Worldpanel FSS Subset does not include condensed and evaporated and instant milk, chilled flavoured milk, or ambient flavoured milk
High	Cheese	Intake24 does not include cheese in mixed dishes
High	Yoghurt	
High	Butter	
High	Margarine, lard, cooking oil	
High	Soft Drinks, diet	
High	Confectionery	
High	Biscuits	
High	Fruit	Worldpanel FSS Subset does not include chilled and prepared fruit
Medium	Eggs	
Medium	Fresh Cream	Worldpanel FSS Subset does not include canned cream
Medium	Cakes and pastries	
Medium	Bread	
Medium	Soft Drinks	Intake24 includes all fruit juice whereas Worldpanel FSS Subset is only ambient fruit juice
Low	Ready Meals	Intake24 includes homemade meals. Worldpanel FSS Subset does not include frozen ready meals
Low	Meat	Intake24 is total weight of mixed dishes containing meat, poultry and game. Worldpanel FSS Subset does not include canned or frozen meats
Low	Desserts	Worldpanel FSS Subset does not include frozen confectionery
Low	Pizza and bases	Worldpanel FSS Subset does not include frozen pizza or ambient pizza bases
Low	Soup	Worldpanel FSS Subset does not include ambient soup
Low	Vegetables	Worldpanel FSS Subset does not include canned, frozen or chilled and prepared vegetables
Low	Nuts	Worldpanel FSS Subset does not include nuts from sweet home cooking or take home savouries sectors

Low	Yoghurt drinks, smoothies, milkshakes	
Low	Poultry and game	Worldpanel FSS Subset does not include frozen poultry
Low	Crisps	Worldpanel FSS Subset sector includes crisps, popcorn, nuts
Low	Fish	
Low	Frozen confectionery and ice cream	
Low	Sauces and condiments	
Low	Dry noodles and rice	Intake24 does not contain dry products, these items would be in mixed dishes
Cannot compare	Flavoured alcoholic beverages	
Cannot compare	Other convenience	
Cannot compare	Frozen prepared foods	Intake24 does not distinguish between frozen, canned or fresh for most foods
Cannot compare	Tea and coffee	Intake24 is weight as consumed (with water)
Cannot compare	Packet breakfast	Intake24 is weight as consumed (with water)
Cannot compare	Sweet home baking	
Cannot compare	Ambient slimming products	
Cannot compare	Canned goods	Intake24 does not distinguish between frozen, canned or fresh for most foods
Cannot compare	Savoury home cooking	
Cannot compare	Mixed dishes, sandwiches, and homemade items	Items in Intake24 that cannot be matched to Worldpanel FSS Subset items due to cooking and mixes of ingredients after purchase

The weighted mean percentage contribution of comparison food groups to energy, fat, saturated fat, carbohydrates, fibre, total sugars, and sodium of intake from supermarket purchases in the SHeS/DISH datasets is presented in **Table 4**. The comparison food groups represent approximately 71% of total reported energy intake (27% from 'high confidence' comparison groups), 75% of fat intake, 78% of saturated fat intake, 67% of carbohydrate intake, 61% of fibre intake, 77% of total sugars intake, and 71% of sodium intake.

Table 4. Weighted mean percentage contribution of comparison food groups to energy and nutrients from supermarket purchases in the Scottish Health Survey (2021) and Dietary Intake in Scotland's cHildren (2024) Intake24 dataset. Blue = high confidence comparison. Green = medium confidence comparison. Orange = low confidence comparison. Gray = cannot compare.

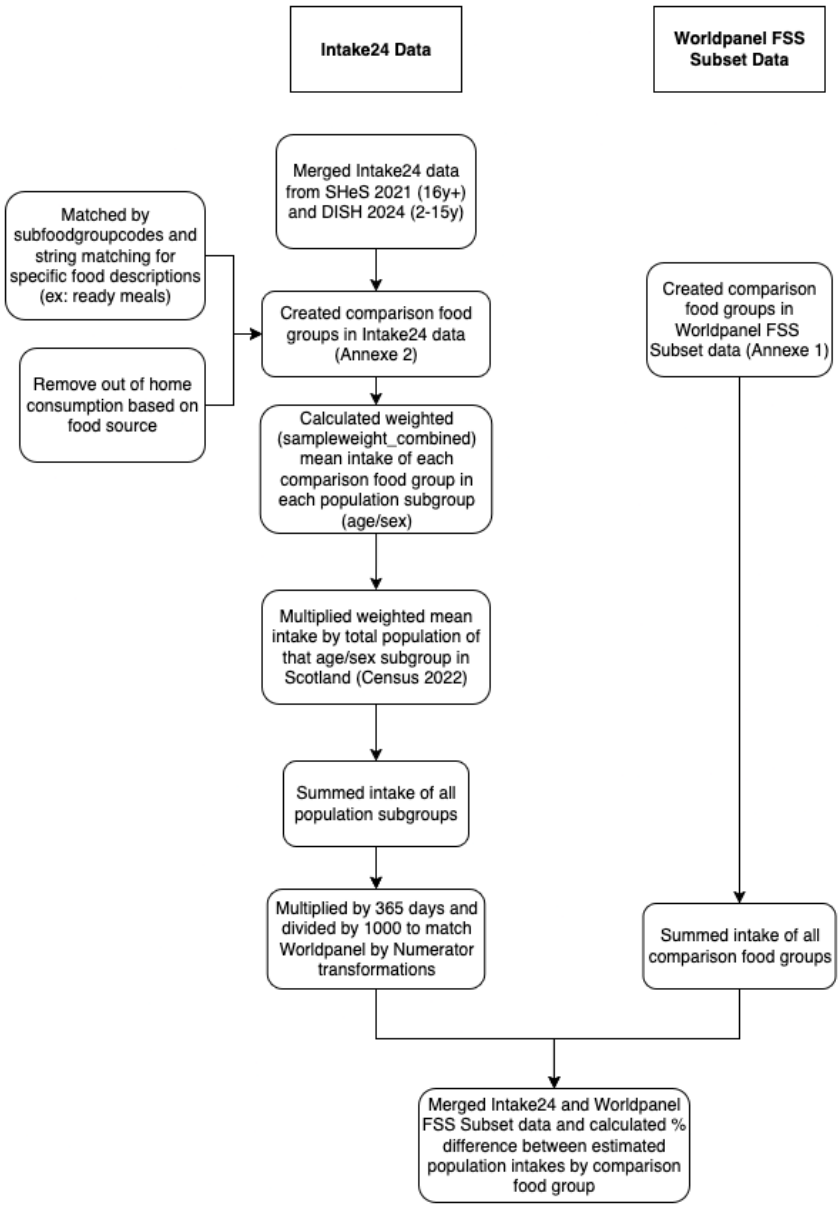
Comparison Group	Energy	Fat	Saturated Fat	Carbs	Fibre	Total Sugars	Sodium
Beer+Lager	0.5	0.0	0.0	0.4	0.0	0.9	0.1
Biscuits	5.2	6.0	7.0	6.0	4.7	6.0	3.7
Butter	1.5	4.0	6.0	0.0	0.0	0.0	0.9
Cheese	2.1	4.1	6.0	0.2	0.2	0.2	3.7
Cider	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Confectionery	3.6	4.0	5.0	3.8	2.1	7.0	1.0
Fruit	4.8	1.2	0.8	8.0	11.0	17.0	0.5
Margarine, lard, cooking oil	0.6	1.9	1.7	0.0	0.0	0.0	0.5
Milk	5.5	7.0	11.0	3.7	0.3	10.0	5.2
Non Alcoholic Beer	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Soft Drinks, diet	0.2	0.0	0.0	0.3	0.0	1.0	1.3
Spirits	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Wine	0.7	0.0	0.0	0.1	0.0	0.3	0.1
Yoghurt	1.8	2.0	3.1	1.7	0.5	3.4	1.3
Bread	9.0	4.0	3.0	14.0	14.0	3.6	13.0
Cakes and pastries	3.2	3.6	4.0	3.5	2.4	3.7	2.4
Eggs	1.3	2.5	2.4	0.0	0.0	0.1	2.0
Fresh Cream	0.2	0.4	0.5	0.0	0.0	0.0	0.0
Soft Drinks	2.3	0.0	0.0	4.1	0.3	9.0	0.5
Crisps	4.2	6.0	2.1	4.1	3.9	0.9	5.0
Desserts	0.5	0.5	0.8	0.5	0.2	1.0	0.3
Dry noodles and rice	3.0	2.0	1.8	4.0	2.5	0.7	1.8
Fish	1.9	2.5	1.5	0.8	0.9	0.3	2.6
Frozen confectionery and ice cream	0.7	0.9	1.4	0.7	0.3	1.3	0.2
Meat	6.0	9.0	9.0	2.3	3.3	1.2	9.0
Nuts	1.1	2.2	1.3	0.2	1.2	0.3	0.4
Pizza and bases	2.1	2.2	2.4	2.1	1.9	0.9	3.0
Poultry and game	3.7	4.0	3.0	1.3	2.3	0.7	4.0
Ready Meals	1.2	1.2	1.2	1.2	1.4	0.5	1.7
Sauces and condiments	0.9	1.4	0.8	0.8	0.6	1.6	3.6
Soup	0.1	0.1	0.1	0.2	0.2	0.2	0.6
Vegetables	1.5	1.6	1.0	1.5	6.0	2.8	1.3
Yoghurt drinks, juice, smoothies, milkshakes	1.1	0.8	1.0	1.3	1.1	2.6	0.8

Ambient slimming products	0.1	0.1	0.1	0.1	0.1	0.2	0.1
Canned goods	1.2	0.8	0.7	1.2	2.8	1.3	2.1
Mixed dishes, sandwiches, and homemade items	15.0	16.0	15.0	13.0	17.0	6.0	20.0
Flavoured alcoholic beverages	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Frozen prepared foods	4.0	3.4	2.1	5.0	7.0	1.3	2.2
Packet breakfast	7.0	3.3	3.0	11.0	11.0	8.0	3.9
Sweet home baking	1.2	0.6	0.5	1.8	0.2	4.0	0.1
Tea and coffee	0.7	0.5	0.7	0.7	0.1	1.6	0.6

3.4. Approach to Comparing National Surveys to Worldpanel FSS Subset

Figure 4 provides an overview of the approach to comparing SHeS/DISH to Worldpanel FSS Subset. We derived the calories, fat, saturated fat, carbohydrates, fibre, total sugars, and sodium from each food group at the population level. For SHeS/DISH, we calculated the weighted mean daily intake of these nutrients from each food group for each of 20 age and sex groups. The weighting in SHeS/DISH was not re-scaled for population total estimates and therefore the weights cannot be used alone to get whole population summaries directly. To get whole population summaries, we then multiplied the mean intake by the respective population of that age/sex group using 2022 Scottish Census data (Scottish Government, 2022a) (**Annexe 3**) and summed up the intakes across these 20 population subgroups to get an estimate of the total population intake on a given day. This was then multiplied by 365 days to get an annual estimate to match Worldpanel FSS Subset.

Figure 4. Flow diagram for comparing national surveys using Intake24—Scottish Health Survey (SHeS, 2021) and Dietary Intake in Scotland's cHildren (DISH, 2024)—to Worldpanel FSS Subset.



3.5. Summary of Important Methodological Differences

In addition to the differences in what is included or not included in the food groups, as noted in **Annexe 2**, SHeS/DISH and Worldpanel FSS Subset differ in the following ways:

- SHeS/DISH nutrient data (on energy, fat, saturated fat, carbohydrates, fibre, total sugars, and sodium) are from the UK Nutrient Databank (NDB). The NDB is derived through an integration of the UK Composition of Foods Integrated Dataset, information from manufacturers' food labels and website information, and the Food Standards Agency Food Recipes Database. The Worldpanel FSS Subset nutrient data are from product packaging except for alcohol and non-barcoded products (e.g., produce) for which McCance and Widdowson is used.
- SHeS/DISH are representative samples of the Scottish population. The panel is designed to be representative of Great Britain as a whole, using demographic and regional controls to reflect the full GB population sample.
- Worldpanel FSS Subset only includes food and drink purchased from retail shops and does not include specialty retail shops such as local butchers, bakeries, ethnic food shops, pharmacies with grab and go food, or meal delivery boxes.

4. Results: mis-reporting of food groups

4.1. Energy

The percentage difference in energy reported for high confidence food groups varied from 13% for ‘Yoghurt’ and ‘Fruit’ to 160% for ‘Spirits’ (**Figure 5** and **Annexe 4)**.

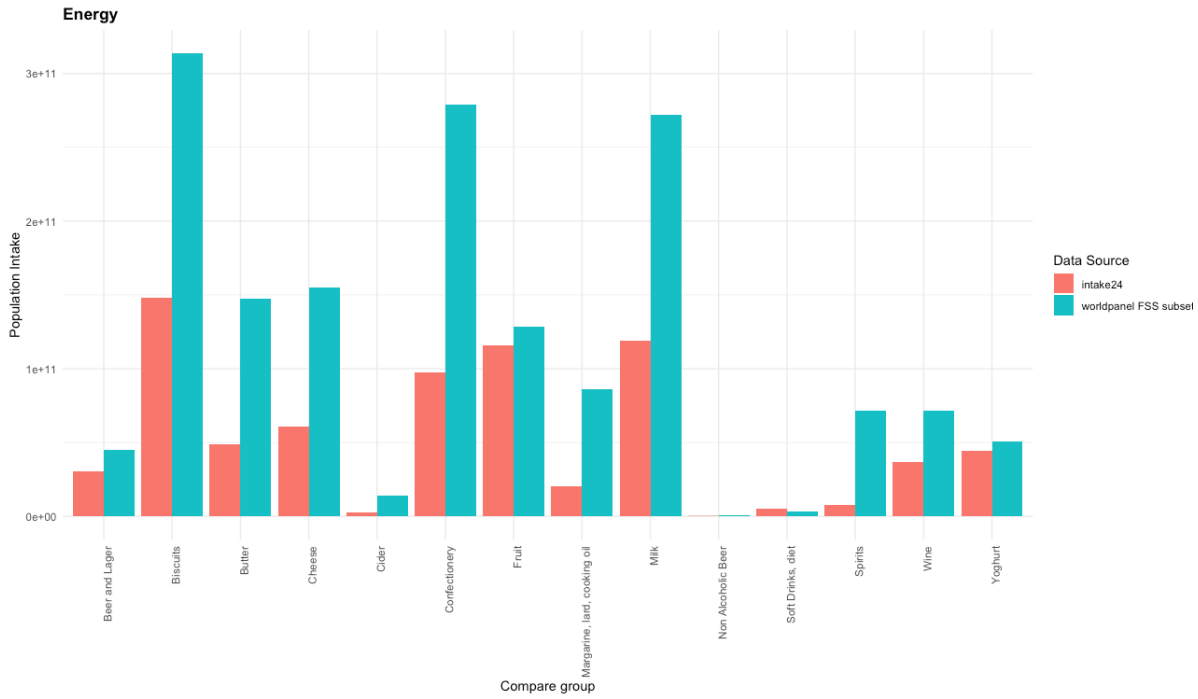
Of the 14 high confidence food groups, 13 (93%) had higher energy intakes in Worldpanel FSS Subset than in Intake24. The only high confidence food group with higher energy intakes in Intake24 was ‘Soft drinks, diet’ (51% difference), which may be due to the exclusion of grab and go drinks in Worldpanel FSS Subset.

All 5 medium confidence food groups (100%) had higher intakes in Worldpanel FSS Subset than in Intake24. Of the 14 low confidence food groups, 10 (71%) had higher intakes in Worldpanel FSS Subset than in Intake24.

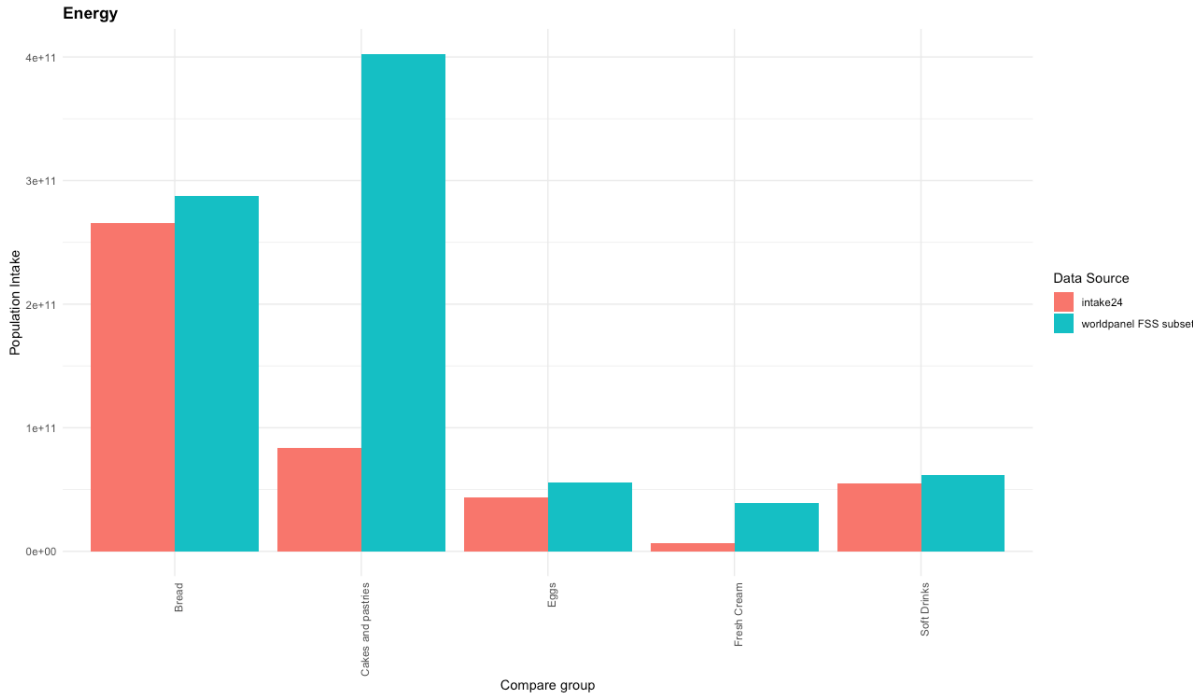
Among high and medium confidence food groups, 13 differed by more than 50% (in increasing order of percentage difference): ‘Soft Drinks, diet’, ‘Wine’, ‘Biscuits’, ‘Milk’, ‘Non Alcoholic Beer’, ‘Cheese’, ‘Confectionery’, ‘Butter’, ‘Margarine, lard, cooking oil’, ‘Cakes and pastries’, ‘Fresh Cream’, ‘Cider’, and ‘Spirits’. Those that differed by less than 50% were: ‘Bread’, ‘Fruit’, ‘Soft Drinks’, ‘Yoghurt’, ‘Eggs’, and ‘Beer and Lager’.

Figure 5. Comparison of energy intake reported in Intake24 (Scottish Health Survey 2021 and Dietary Intake in Scotland's cHildren 2024) versus Worldpanel FSS Subset for food groups with (A) high- and (B) medium- confidence for direct comparisons between data sources.

(A)



(B)



4.2. Fat

The percentage difference in fat reported for high confidence food groups varied from 1% for ‘Yoghurt’ to 122% for ‘Margarine, lard, cooking oil’ (**Figure 6** and **Annexe 4**). Alcohol comparison groups and ‘Soft drinks, diet’, had a 200% difference, due to the lack of fat in Intake24 for these groups.

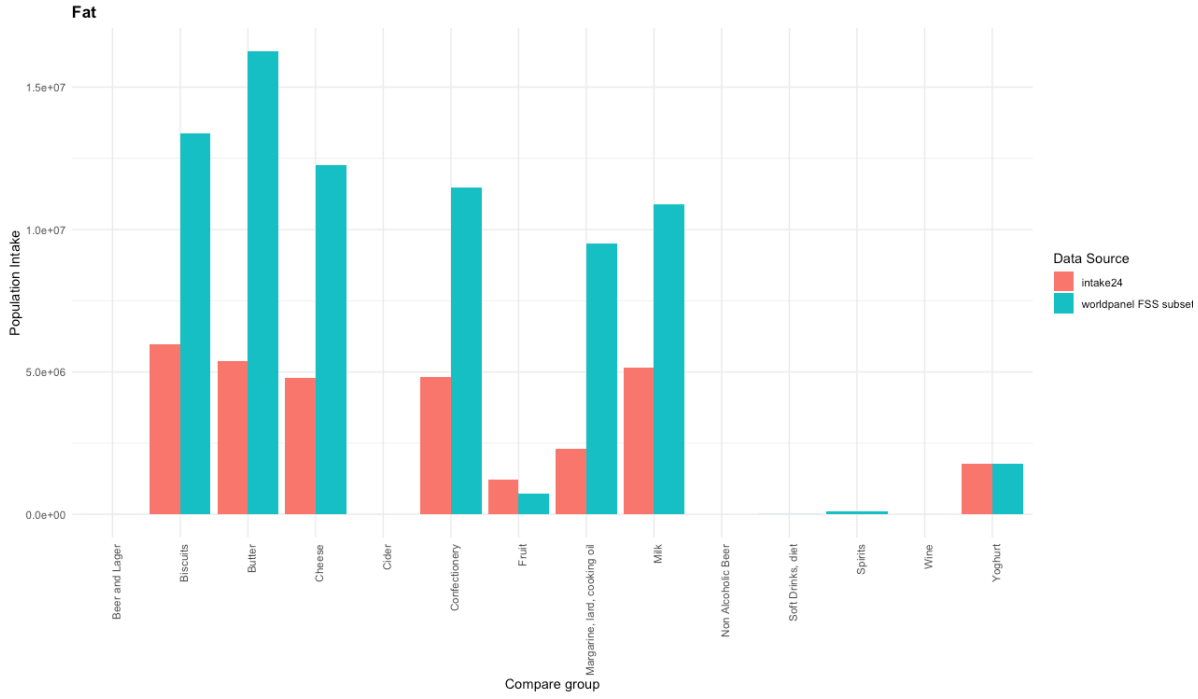
Of the 14 high confidence food groups, 12 (86%) had higher fat intakes in Worldpanel FSS Subset than in Intake24. Of the 5 medium confidence food groups, 4 (80%) had higher fat intakes in Worldpanel FSS Subset than in Intake24. Of the 14 low confidence food groups, 8 (57%) had higher fat intakes in Worldpanel FSS Subset than in Intake24.

Among the high confidence food groups, ‘Yoghurt’ had a 1% difference, with fat intakes from Intake24 slightly higher than Worldpanel FSS Subset. Of the medium confidence food groups, ‘Bread’ had higher fat intakes in Intake24 than Worldpanel FSS Subset (12% difference).

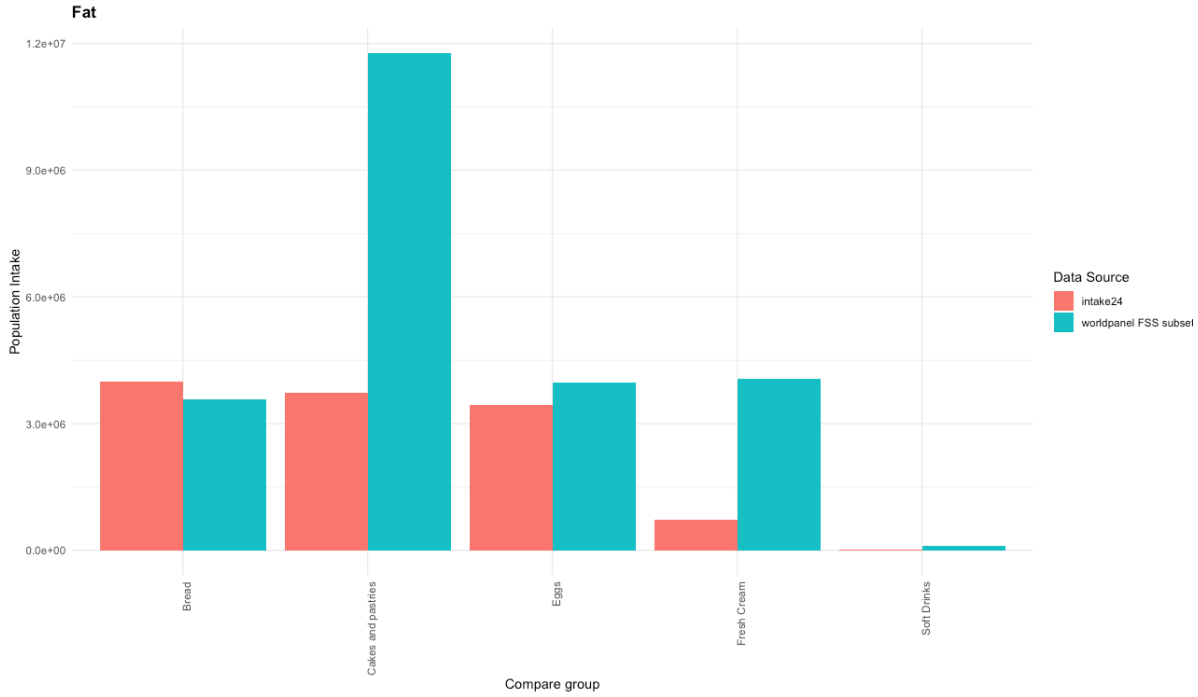
Among high and medium confidence food groups, 15 differed by 50% or more (in increasing order of percentage difference): ‘Fruit’, ‘Milk’, ‘Biscuits’, ‘Confectionery’, ‘Cheese’, ‘Butter’, ‘Cakes and pastries’, ‘Margarine, lard, cooking oil’, ‘Fresh Cream’, ‘Soft Drinks’, ‘Soft Drinks, diet’, ‘Non Alcoholic Beer’, ‘Wine’, ‘Beer and Lager’, ‘Cider’, and ‘Spirits’. Those that differed by less than 50% were: ‘Yoghurt’, ‘Bread’, and ‘Eggs’.

Figure 6. Comparison of fat intake reported in Intake24 (Scottish Health Survey 2021 and Dietary Intake in Scotland's cHildren 2024) versus Worldpanel FSS Subset for food groups with (A) high and (B) medium for direct comparisons between data sources.

(A)



(B)



4.3. Saturated Fat

The percentage difference in saturated fat reported for high confidence food groups varied from 5% for ‘Yoghurt’ to 127% for ‘Margarine, lard, cooking oil’ (**Figure 7** and **Annexe 4**). Alcohol comparison groups and ‘Soft drinks, diet’, had a 200% difference, due to the lack of fat in Intake24 for these groups.

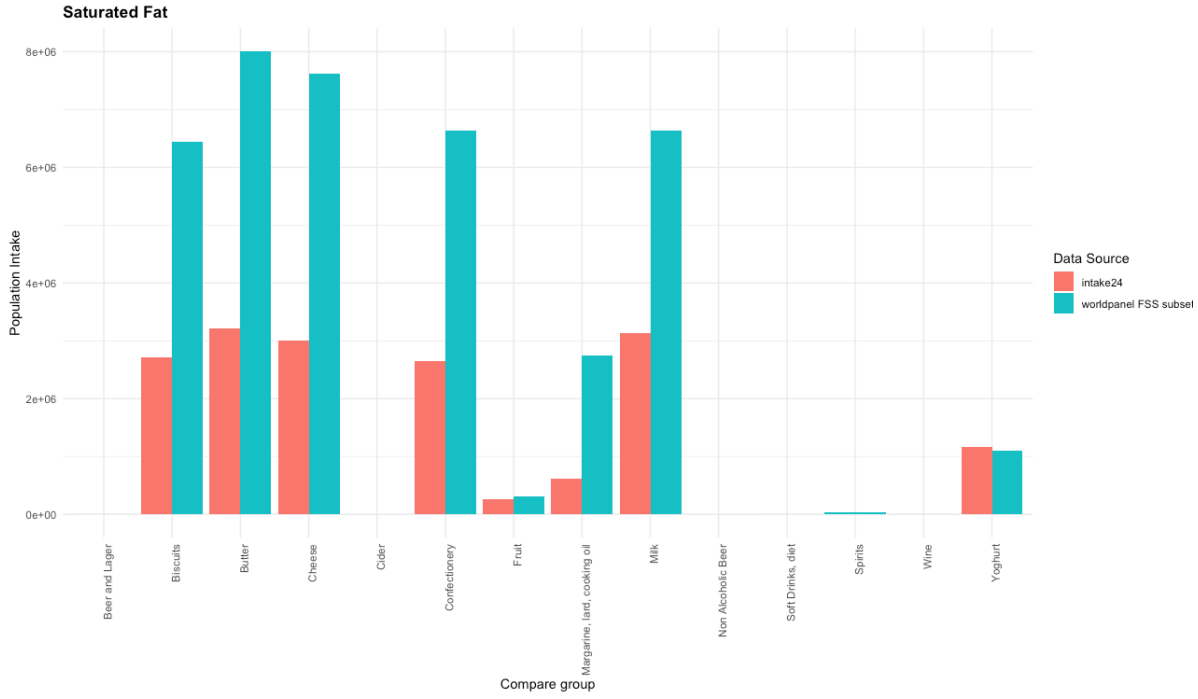
Of the 14 high confidence food groups, 13 (93%) had higher saturated fat intakes in Worldpanel FSS Subset than in Intake24. Of the 5 medium confidence food groups, 3 (60%) had higher saturated fat intakes in Worldpanel FSS Subset than in Intake24. Of the 14 low confidence food groups, 8 (57%) had higher saturated fat intakes in Worldpanel FSS Subset than in Intake24.

The only high confidence comparison group with higher saturated fat intakes in Intake24 was ‘Yoghurt’. In the medium confidence group, ‘Bread’ and ‘Eggs’ had higher saturated fat intakes in Intake24 compared to Worldpanel FSS Subset, with a 40% difference and 17% difference respectively.

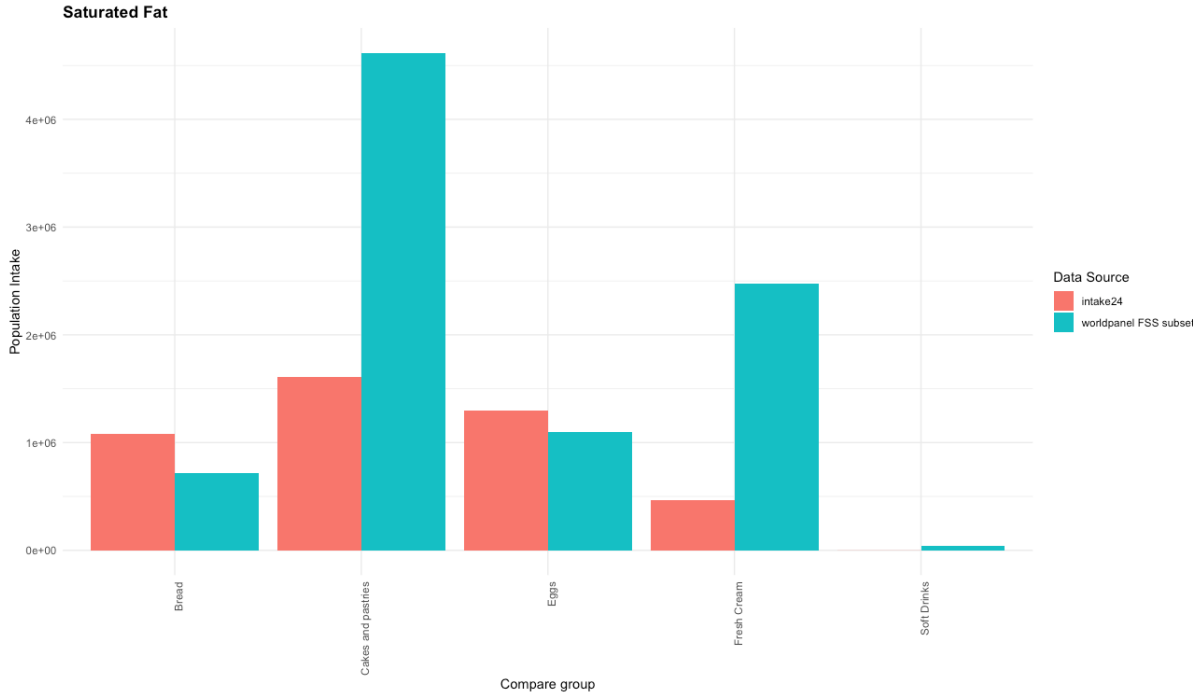
Among high and medium confidence food groups, 15 differed by 50% or more (in increasing order of percentage difference): ‘Milk’, ‘Biscuits’, ‘Butter’, ‘Confectionery’, ‘Cheese’, ‘Cakes and pastries’, ‘Margarine, lard, cooking oil’, ‘Fresh Cream’, ‘Soft Drinks’, ‘Soft Drinks, diet’, ‘Non Alcoholic Beer’, ‘Wine’, ‘Beer and Lager’, ‘Cider’, and ‘Spirits’. Those that differed by less than 50% were: ‘Yoghurt’, ‘Eggs’, ‘Fruit’, and ‘Bread’.

Figure 7. Comparison of saturated fat intake reported in Intake24 (Scottish Health Survey 2021 and Dietary Intake in Scotland's cHildren 2024) versus Worldpanel FSS Subset for food groups with (A) high and (B) medium for direct comparisons between data sources.

(A)



(B)



4.4. Carbohydrates

The percentage difference in carbohydrates reported for high confidence food groups varied from 10% for ‘Yoghurt’ to 141% for ‘Margarine, lard, cooking oil’ and ‘Spirits’ had the highest percentage difference of the alcohol groups (186%) (**Figure 8** and **Annexe 4**).

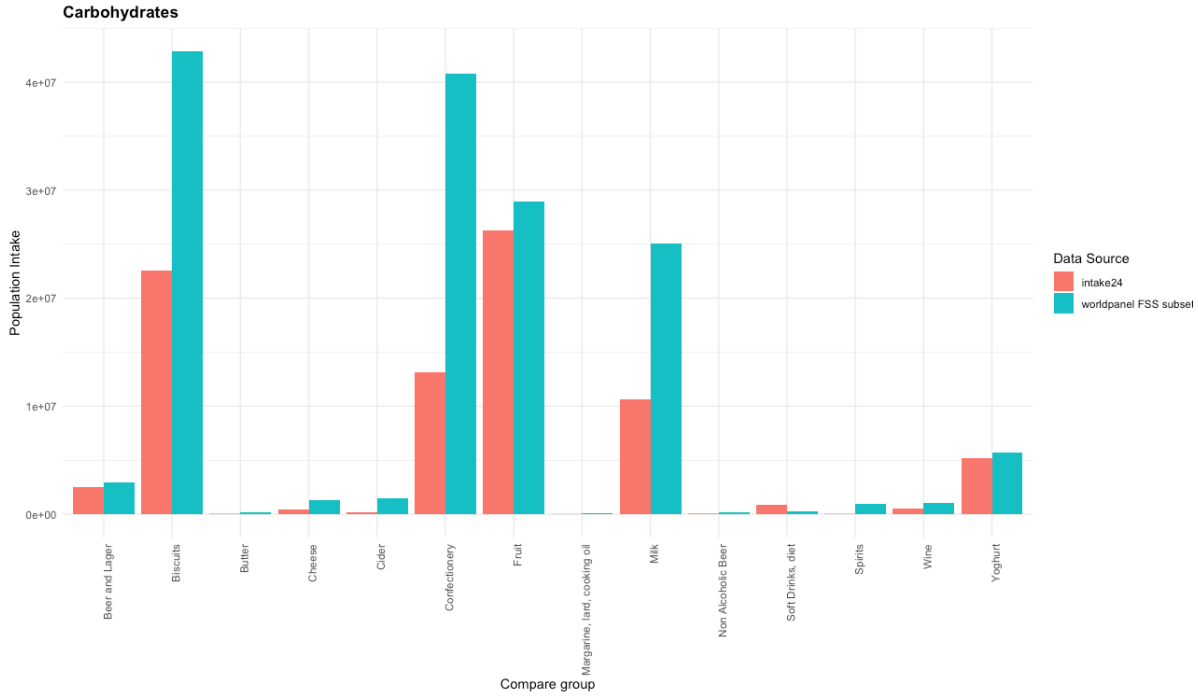
Of the 14 high confidence food groups, 13 (93%) had higher intakes in Worldpanel FSS Subset than in Intake24. Of the 5 medium confidence food groups, 4 (80%) had higher intakes in Worldpanel FSS Subset than in Intake24. Of the 14 low confidence food groups, 8 (57%) had higher intakes in Worldpanel FSS Subset than in Intake24.

The only high confidence comparison group with higher intakes in Intake24 was ‘Soft drinks, diet’. In the medium-confidence group, ‘Bread’ and ‘Soft Drinks’ had similar intakes, with the percentage difference being only 1% and 2% respectively. While carbohydrate intakes from ‘Bread’ are similar, sandwiches in Intake24 have been excluded from this analysis as Intake24 does not include enough detail to determine if the sandwich was made at home using supermarket ingredients or was a pre-made grab and go sandwich, and thus the bread intake would be expected to be lower in Intake24.

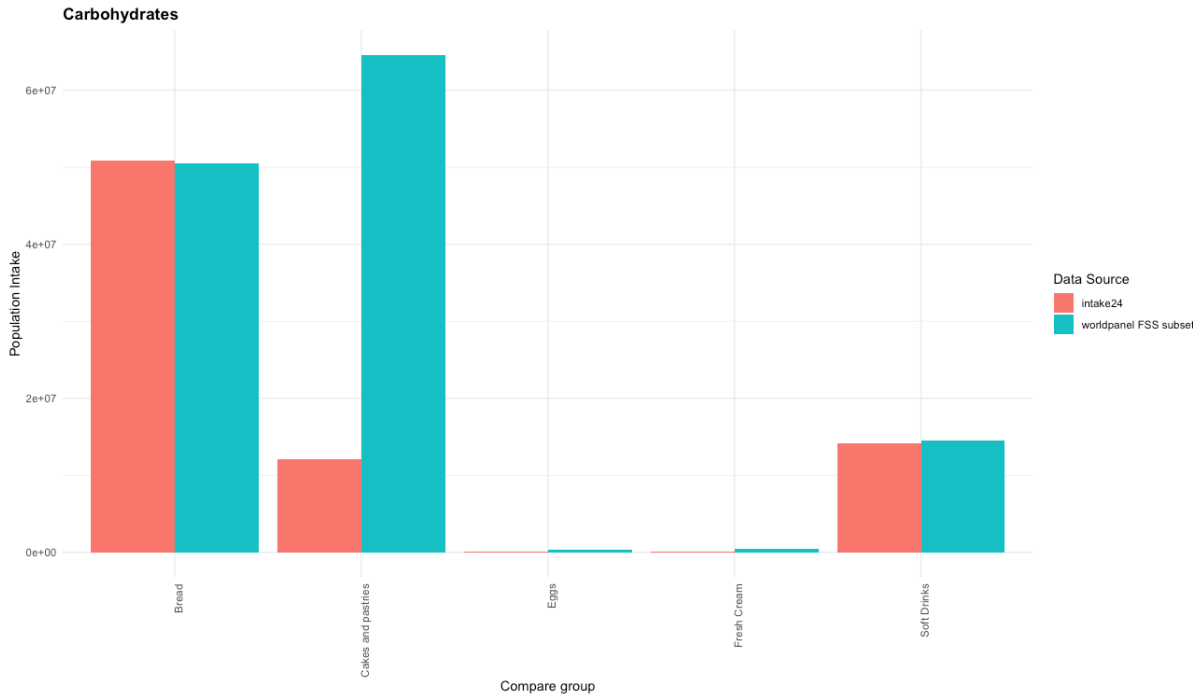
Among high and medium confidence food groups, 14 differed by 50% or more (in increasing order of percentage difference): ‘Biscuits’, ‘Wine’, ‘Milk’, ‘Non Alcoholic Beer’, ‘Soft Drinks, diet’, ‘Cheese’, ‘Confectionery’, ‘Butter’, ‘Cakes and pastries’, ‘Eggs’, ‘Margarine, lard, cooking oil’, ‘Cider’, ‘Fresh Cream’, and ‘Spirits. Those that differed by less than 50% were: ‘Bread’, ‘Soft Drinks’, ‘Yoghurt’, ‘Fruit’, and ‘Beer and Lager’.

Figure 8. Comparison of carbohydrate intake reported in Intake24 (Scottish Health Survey 2021 and Dietary Intake in Scotland's cHildren 2024) versus Worldpanel FSS Subset for food groups with (A) high and (B) medium for direct comparisons between data sources.

(A)



(B)



4.5. Fibre

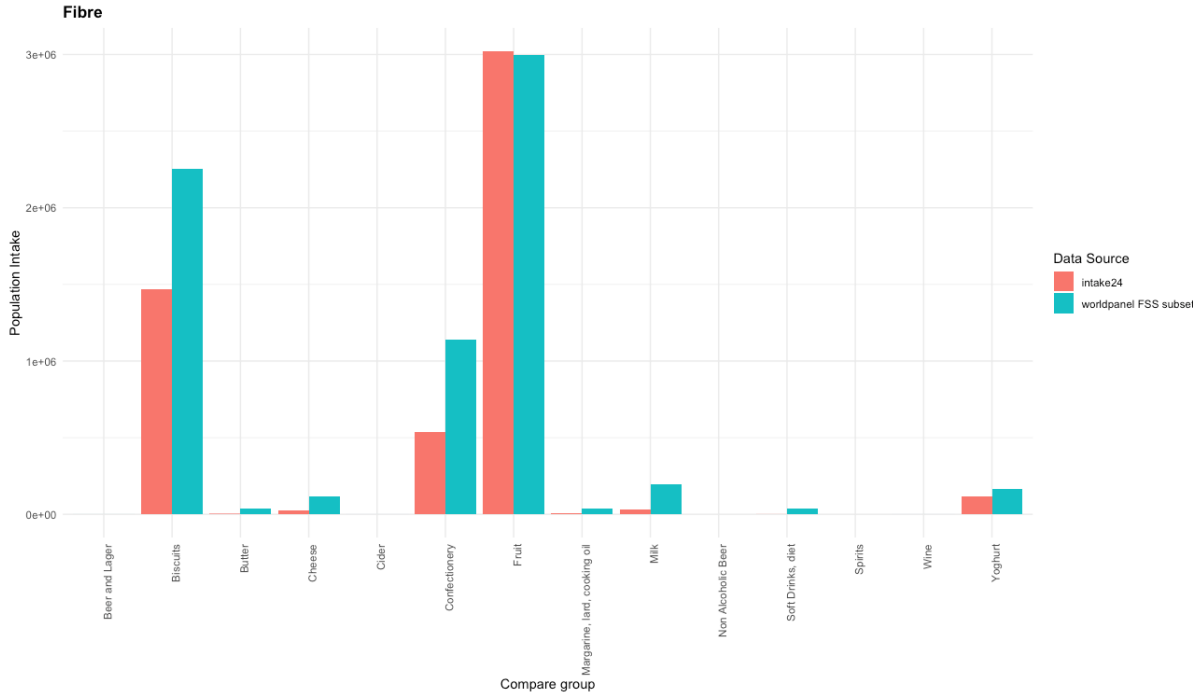
The percentage difference in fibre reported for high confidence food groups varied from 1% for ‘Fruit’ to 164% for ‘Butter’ and ‘Beer and Lager’, ‘Cider’ and ‘Wine’ had the highest difference in alcohol groups (200%) (**Figure 9** and **Annexe 4**).

Of the 14 high confidence food groups, 11 (79%) had higher fibre intakes in Worldpanel FSS Subset than in Intake24, with the exclusion of ‘Non Alcoholic Beer’ and ‘Spirits’, which had no fibre intake in both Intake24 and Worldpanel FSS Subset. ‘Fruit’ differed by only 1% difference and had higher intakes in Intake24 compared to Worldpanel FSS Subset. All 5 medium confidence food groups (100%) had higher fibre intakes in Worldpanel FSS Subset than in Intake24, though ‘Bread’ differed by only 3% difference. Of the 14 low confidence food groups, 7 (50%) had higher fibre intakes in Worldpanel FSS Subset than in Intake24.

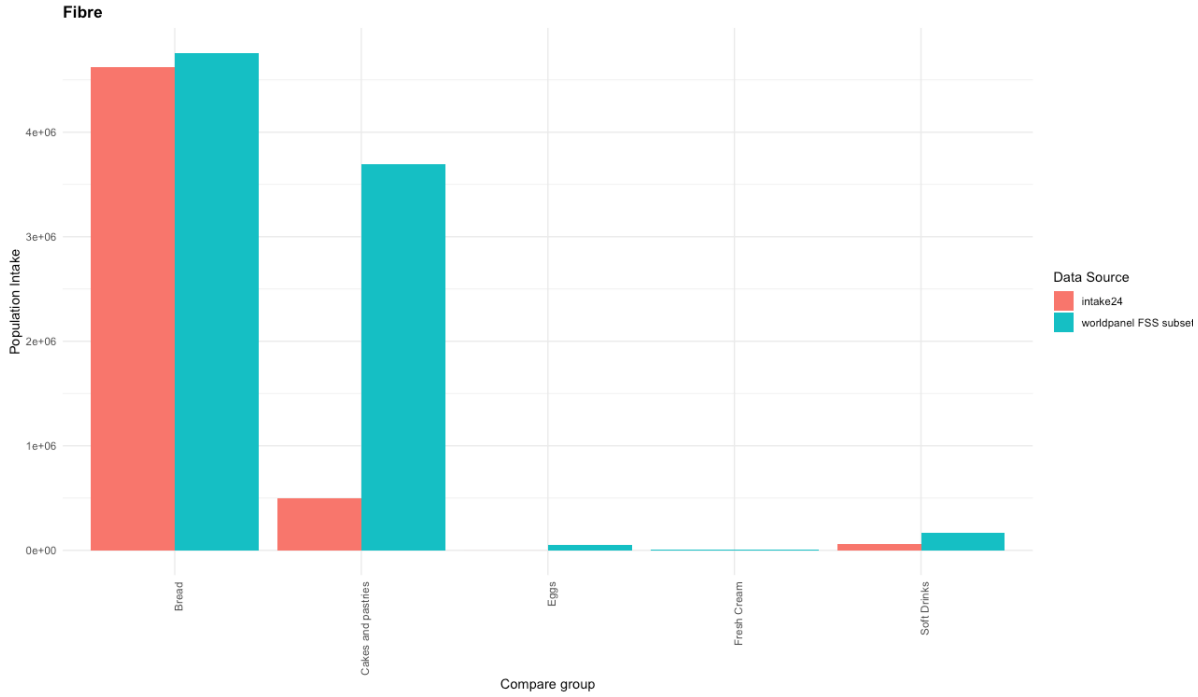
Among high and medium confidence food groups, 13 differed by 50% or more (in increasing order of percentage difference): ‘Confectionery’, ‘Soft Drinks’, ‘Cheese’, ‘Margarine, lard, cooking oil’, ‘Milk’, ‘Cakes and pastries’, ‘Butter’, ‘Soft Drinks, diet’, ‘Eggs’, ‘Beer and Lager’, ‘Wine’, ‘Cider, and ‘Fresh Cream’. Those that differed by less than 50% were: ‘Non Alcoholic Beer’, ‘Spirits’, ‘Bread’, ‘Fruit’, ‘Yoghurt’, and ‘Biscuits’.

Figure 9. Comparison of fibre intake reported in Intake24 (Scottish Health Survey 2021 and Dietary Intake in Scotland's cHildren 2024) versus Worldpanel FSS Subset for food groups with (A) high and (B) medium for direct comparisons between data sources.

(A)



(B)



4.6. Total Sugars

The percentage difference in total sugars reported for high confidence food groups varied from 6% for ‘Yoghurt’ to 161% for ‘Margarine, lard, cooking oil’ and ‘Spirits’ had the highest percentage difference for alcohol groups (185%) (**Figure 10** and **Annexe 4**).

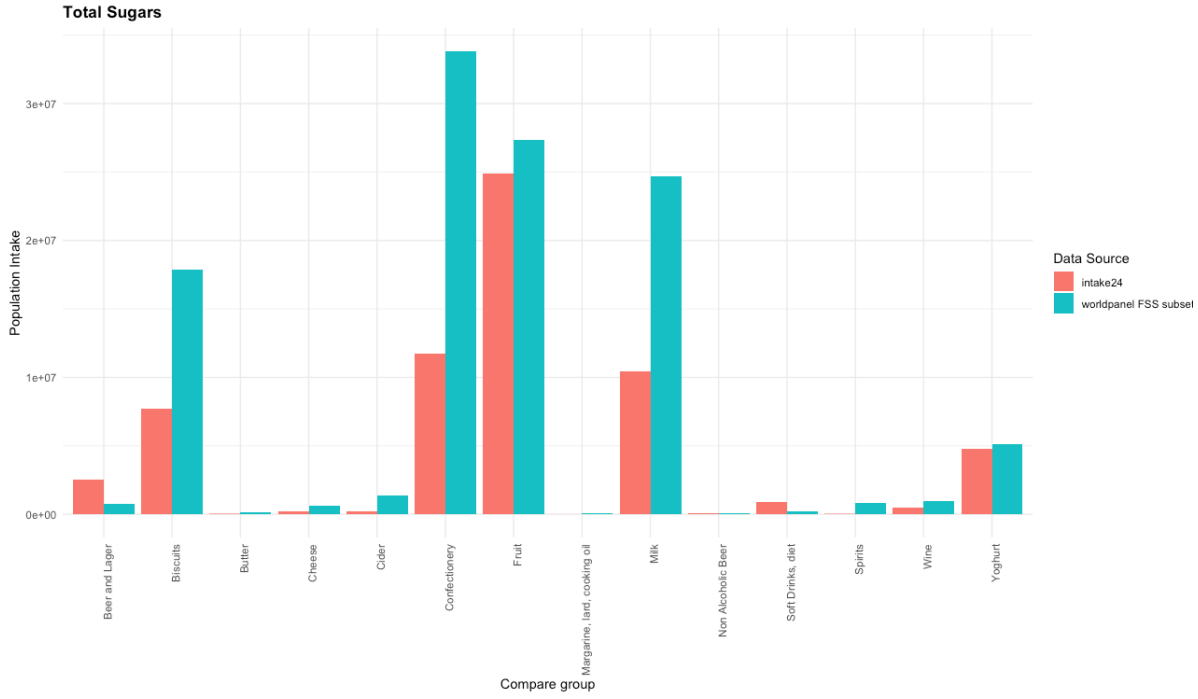
Of the 14 high confidence food groups, 11 (77%) had higher total sugars intake in Worldpanel FSS Subset than in Intake24. Of the 5 medium confidence food groups, 4 (80%) had higher total sugars intake in Worldpanel FSS Subset than in Intake24. Of the 14 low confidence food groups, 8 (79%) had higher total sugars intakes in Worldpanel FSS Subset than in Intake24.

The only high confidence food groups with higher total sugars intake in Intake24 were ‘Non Alcoholic Beer’ (20%), ‘Beer and Lager’ (104%), and ‘Soft Drinks, diet’ (117%).

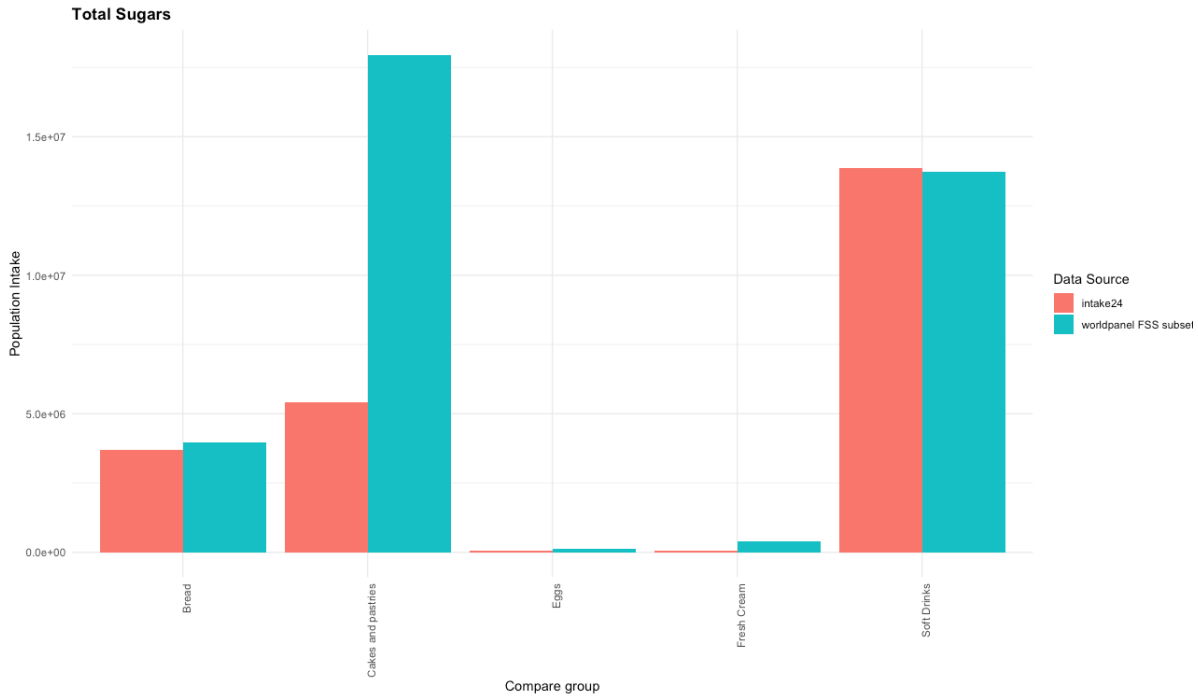
Among high and medium confidence food groups, 14 differed by 50% or more (in increasing order of percentage difference): ‘Wine’, ‘Biscuits’, ‘Milk’, ‘Cheese’, ‘Eggs’, ‘Confectionery’, ‘Butter’, ‘Beer and Lager’, ‘Cakes and pastries’, ‘Soft Drinks, diet’, ‘Cider’, ‘Fresh Cream’, ‘Margarine, lard, cooking oil’, and ‘Spirits’. Those that differed by less than 50% were: ‘Soft drinks’, ‘Yoghurt’, ‘Bread’, ‘Fruit’, and ‘Non Alcoholic Beer’.

Figure 10. Comparison of total sugars intake reported in Intake24 (Scottish Health Survey 2021 and Dietary Intake in Scotland's cHildren 2024) versus Worldpanel FSS Subset for food groups with (A) high and (B) medium for direct comparisons between data sources.

(A)



(B)



4.7. Sodium

The percentage difference in sodium reported for high confidence food groups varied from 21% for ‘Yoghurt’ to 106% for ‘Fruit’ and alcohol groups varied from 21% for ‘Non Alcoholic Beer’ to 194% for ‘Spirits’ (**Figure 11** and **Annexe 4**).

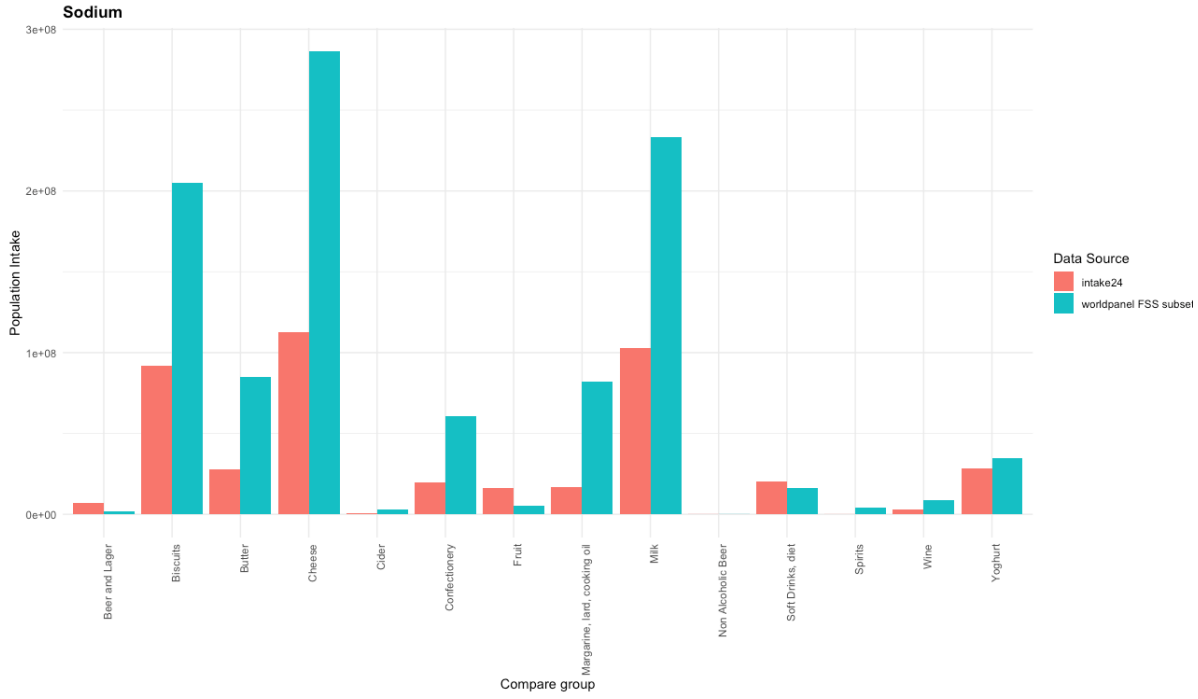
Of the 14 high confidence food groups, 11 (78%) had higher sodium intakes in Worldpanel FSS Subset than in Intake24. Of the 5 medium confidence food groups 4 (80%) had higher intakes in Worldpanel FSS Subset than in Intake24. Of the 14 low confidence food groups, 9 (64%) had higher intakes in Worldpanel FSS Subset than in Intake24.

In high-confidence comparison groups, ‘Soft Drinks, diet’ (23%), ‘Fruit’ (106%), and ‘Beer and Lager’ (120%) had higher sodium intakes in Intake24 than Worldpanel FSS Subset. Of the medium confidence food groups, ‘Eggs’ (54%) had more sodium in Intake24 compared to Worldpanel FSS Subset, which may be accounted for given that egg items in Intake24 can include ingredients used to cook the egg.

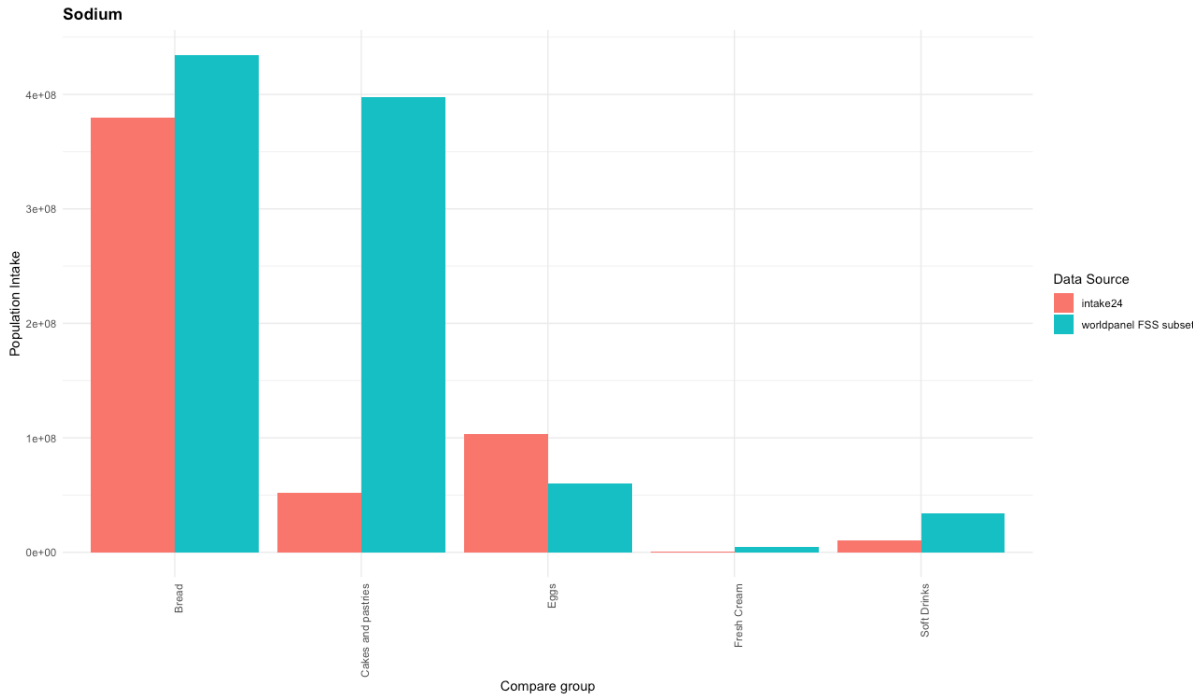
Among high and medium confidence food groups, 15 differed by 50% or more (in increasing order of percentage difference): ‘Eggs’, ‘Biscuits’, ‘Milk’, ‘Cheese’, ‘Wine’, ‘Butter’, ‘Confectionery’, ‘Soft drinks’, ‘Fruit’, ‘Beer and Lager’, ‘Margarine, lard, cooking oil’, ‘Cider’, ‘Fresh Cream’, ‘Cakes and pastries’, and ‘Spirits’. Those that differed by less than 50% were: ‘Bread’, ‘Soft Drinks, diet’, ‘Non Alcoholic Beer’, and ‘Yoghurt’.

Figure 11. Comparison of sodium intake reported in Intake24 (Scottish Health Survey 2021 and Dietary Intake in Scotland's cHildren 2024) versus Worldpanel FSS Subset for food groups with (A) high and (B) medium for direct comparisons between data sources.

(A)



(B)



5. Conclusions and recommendations

In this recent national comparison of food groups representing 71% of total reported energy intake in SHeS/DISH, alcohol, biscuits, confectionary, cakes and pastries were among the most under-reported foods, for energy, fat, saturated fat, carbohydrates, and total sugars. Fibre from some of these foods was also under-reported. However, it is worthwhile to note that a 2024 Waste and Resources Action Programme (WRAP) report found that bakery items accounted for 23% of food waste and thus some of the difference may be due to food waste rather than under-reporting for this food group (WRAP, 2024). Not all unhealthy foods were under-reported: soft drinks, in particular, were not under-reported; though some of the lack of difference in this category may be due to the exclusion of grab and go soft drinks and chilled fruit juice in the Worldpanel FSS Subset data. Diet soft drinks had higher intakes of energy, carbohydrates, total sugars and sodium in Intake24 compared to Worldpanel FSS Subset; because this food group is more comparable than non-diet soft drinks, this difference is likely related to the exclusion of grab and go soft drinks in Worldpanel FSS Subset.

Bread, yoghurt, fruit, and eggs tended to be comparable between the data sources for both energy and nutrients. Bread had a percentage difference of only 8% for energy intake, with higher amounts reported by Worldpanel FSS Subset, however Intake24 data showed higher fat (percentage difference of 12%) and saturated fat (percentage difference of 40%) intakes from bread. Sandwiches were not able to be included as Worldpanel FSS Subset data did not include grab and go sectors and as such, differences here may be due to some bread being purchased for made-at-home sandwiches which could not be included in the Intake24 data for comparison.

Yoghurt had higher saturated fat intake in Intake24 compared to Worldpanel FSS Subset data (percentage difference of 5%), but the percentage difference of energy intake was only 13% and fat intake differed by only 1%. As yoghurt is less likely to be purchased to be used in mixed dishes, comparisons within this category have high confidence. The under-reporting found in this category is consistent with an article from the literature review which found that yoghurt was the second most omitted item with an omission rate of 42.9% (Raffoul et al., 2019).

Fruit had a percentage difference of 10% with higher energy intake from Worldpanel FSS Subset, and a 10% difference of total sugars intake. Intake24 had higher fat (percentage difference 52%) and sodium (percentage difference 106%) for Fruit. However, the percentage difference for fibre intake was only 1%, with higher fibre intakes in Intake24. Fruit is often consumed as a snack, and an article from the literature review similarly found that apples were the most often correctly reported (13.8%) and mis-reported snacks at home, being both most often omitted (17%) and intruded (8.6%) in recalls (Šumonja & Jevtić, 2016).

Eggs had a percentage difference of 24% for energy intake, with higher intakes in Worldpanel FSS Subset. However, eggs had higher intakes of saturated fat (17%) and sodium (percentage difference 54%) in Intake24. Egg sub food groups in Intake24 were restricted to single items that did not include mixed dishes, for example, ‘omelette, plain’ was included but omelettes with meat or vegetables were excluded. Eggs in Intake24 also include items such

as ‘Boiled egg, white only’ and cooking methods such as ‘Egg, fried in butter’ which may contribute to differences in energy and nutrient intakes between Worldpanel FSS Subset and Intake24.

Consistent with a previous controlled feeding study in Aberdeenshire (Garden et al., 2018), we found milk and cream were under-reported. Butter and cheese also tended to be under-reported across energy and nutrients, though this may be due to the granularity of data available for this analysis, as by comparing food groups we were unable to disaggregate the dairy used in mixed dishes in Intake24. Previous work has found that 8% of dairy may be underestimated when not accounting for dairy in composite dishes (Jaacks et al., 2024). In addition, a previous study highlighted that dairy and eggs accounted for 9% of food waste, which may contribute to the differences found in this analysis (WRAP, 2024).

Overall, this report provides clues to help identify food groups which may be mis-reported in 24-hour recalls using Intake24, and future work on mis-reporting is needed to identify and quantify the extent of mis-reporting.

This report is not without limitations:

- While we made every attempt to ensure that food and drink groups were directly comparable, we were not able to entirely decompose what proportion of the mismatch was due to differences in reported intake versus differences in methodology, particularly the underlying sample and nutrient data (for example, a cheese pizza may have more calories per 100g in Worldpanel by Numerator data than in Intake24).
- We were not able to evaluate overall mis-reporting because the total diet could not be directly compared given differences in some of the food and drink groups between Intake24 and Worldpanel FSS Subset. We were able to compare some dairy (Milk, Cheese, Yoghurt, Butter), bread, and discretionary food groups (Biscuits, Confectionary, Cakes and Pastries) which are important contributors to nutrient intake among those living in Scotland.
- Because Worldpanel FSS Subset data is not at the individual level, we were not able to determine if the under-reporting in Intake24 was due to under-reporting of portion size or omitting (i.e. not reporting at all) foods.
- We cannot account for the amount of difference that may be due to food waste rather than mis-reporting of intakes.

Based on these findings, we recommend the following further research and improvements to the monitoring of diets in Scotland:

1. Future analyses could compare household food expenditure data collected as part of the UK-wide Living Costs and Food Survey in single-occupancy households—which make up 37% of households according to the latest Scotland Census data (Scottish Government, 2022a). These data are available at a higher resolution than the Worldpanel FSS Subset expenditure data available for this report and thus we could make more confident comparisons between foods and food groups to triangulate findings.

2. Additional research is needed to understand the nature of under-reporting of milk and cream, observed in our analysis and in a previous controlled feeding study in Aberdeenshire (Garden et al., 2018) identified in our literature review. Yoghurt, on the other hand, appears to be accurately reported. Given the Climate Change Committee's recommendation to reduce dairy consumption, improving our estimation of dairy should be a priority.

3. Intake24 could consider integrating multi-pass questions relating to alcohol intake and snack items.

4. Intake24 could consider reviewing and updating images currently used to assist portion size estimation for biscuits, confectionary, cakes and pastries.

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Annexe 1. Extracted Data from Literature Review

Table 5. Study characteristics

First Author	Publication Year	Data Collection Year(s)	Location	Sample	Sample Size
Casey	2023	2016-2017	USA	• Healthy UG and PG students, community volunteers • Average age 24y (19-32y) • 50% female	24
Garden	2018	Not reported	UK	• Healthy community volunteers	59
Kirkpatrick	2019, 2022	2016	USA	• Low-income mothers • 18 to 82y	302
Widaman	2017	2011-2014	USA	• Average age 37y • 100% female	45
Biltoft-Jensen	2015	2011-2012	Denmark	• Average age 10y • 54% female	193
Carvalho	2015	2013	Portugal	• Average age 9y • 59% female	24
Raffoul	2019	2016	Canada	• Children aged 10-13y • 50% female	100
Sumonja	2016	2014	Serbia	• 1st-4th grade students • 47% female	94
Wallace	2018	2015-2016	Canada	• Children aged 2-5y • 70% female	40
Bennett	2025	2021-2022	Ireland	• 51% Irish, 31% Brazilian, 18% Polish • Average age 39y • 72% female	74
Lucassen	2023	2019-2020	The Netherlands	• Average age 40y • 73% female	215
Söderström	2024	2019-2020	Sweden	• Pregnant women	52

Table 6. Study Results

First Author	Duration	Feeding Procedures	Diet Assessment	Results
Casey	24 days	Meals created at metabolic kitchen and picked up by participants twice per week; told to consume all food and return any uneaten food to the lab on the next visit but this was rarely done	• Participants were trained on using measuring instruments and food props to estimate portion sizes, and given a food amount reporting booklet • Up to six 24-hour dietary recalls, interviewer-administered	• Beef, lean poultry, full-fat cheese, reduced-fat cheese, low-fat yoghurt, reduced-fat margarine, and pasta were over-reported • Lean beef, butter, fat-free yoghurt, reduced fat/fat-free salad dressing, non-citrus fruit, and dark-green vegetables were under-reported
Garden	12 days	Participants were resident in the Human Nutrition Unit and provided with foods and beverages usually consumed (based on baseline 7-day diet history and shopping receipts)	• Six 24-hour dietary recalls, interviewer-administered • Six days' weighed food records • Covert weigh back method	• Milk & milk-based drinks & cream, fruit, water & drinks, and sandwiches & bread were under-reported in both the recalls and diaries • Fruit juices, breakfast cereals, meat, and biscuits were under-reported only in the recalls • Average of 85% of the weight of foods and drinks was recalled, >66% of weight for all food groups except oil, herbs & spices, and salt
Kirkpatrick	1 day	Participants selected and consumed foods from a buffet for breakfast, lunch and dinner	• Direct observation of 3 meals • Web-based self-administered 24-hour dietary recall completed either independently or with assistance from a nutritionist if needed	• Meat was under-reported (mean diff 0.50-0.65 ounce equivalent) • Single-unit foods tended to be under-reported (e.g. apples, bagels, single-serve bags of crisps) vs amorphous/soft foods (e.g. cereal, lasagne) and small pieces (e.g. vegetables in a salad) which tended to be over-reported • Highest match rate for breakfast (83-85%), lowest match rate for lunch (64-67%) • Most common exclusions were additions or ingredients, such as tomatoes, cucumber, or cheese that were part of a salad or sandwich and accounted for an average of 43-46 kcal/person

Widaman	1 day	Meals created by a metabolic kitchen: a morning meal, a midday meal, an afternoon snack, and an evening meal. The morning meal, midday meal, and afternoon snack were consumed at the research centre and the dinner meal was packaged and sent home. Leftovers were returned to the centre using provided containers	One web-based self-administered 24-hour dietary recall	Nuts/seeds, animal protein, dairy, and vegetables were over-reported
Biltoft-Jensen	3 months	During the intervention, New Nordic Diet school meals (mid-morning snack, hot lunch, afternoon snack) were provided that contained more berries, cabbage, root vegetables, legumes, fresh herbs, potatoes, wild plants and mushrooms, whole grains, nuts, fish and seaweed than the average Danish diet; during the control period, students brought their usual packed lunches from home	• Web-based self-administered current-day recall for 8- to 11-year-old children assisted by parents for 7 consecutive days • Direct observation on same 5 school days as the current-day recalls	• Almost two-thirds of intrusions were due to choosing too large a portion size (rather than completely adding a food not actually eaten) • Most omissions were due to choosing too small a portion size (rather than completely omitting a food) • Intrusions (too large a portion size) were more common than omissions (too small a portion size) • No comparisons of food-specific grams
Carvalho	1 day	N/A	• Direct observation of school lunch	• Milk products (23% diff) were over-reported

			• Web-based self-administered 24-hour dietary recall the next day assisted if needed by a nutritionist but not by parents	• All other food groups were under-reported: beverages (44% diff), cereals and potatoes (32% diff), fruit (53% diff), meat, fish and eggs (39% diff), pulses (49% diff), sweets (23% diff) and vegetables (26% diff)
Raffoul	1 day	Catering for one school lunch was provided at school. Meals were weighed to determine the starting meal weight and plate waste was weighed following the lunch	• Direct observation of school lunch • Web-based self-administered 24-hour dietary recall the next day	• The overall match rates were 60% for 10-y-olds, 65% for 11-y-olds, 43% for 12-y-olds, and 72% for 13-y-olds • Dip was the most frequently excluded item (71% did not report the ranch dip), followed by yoghurt (43%), and juice (43%) • 2.36 items were excluded on average • The difference in the average amount reported of milk was 67.3g less than true intake
Sumonja	1 day	N/A	• Direct observation of school lunch • Web-based self-administered 24-hour dietary recall the next day	• Bread was most often correctly reported across meal occasions at home (40.4% at breakfast, 38.3% lunch, 30.9% dinner), as well as the most often omitted item across meal occasions (25.5% breakfast, lunch 19.3%, dinner 20.2%). • Apples were most often correctly reported (13.8%) and mis-reported for snacks at home, being both most often omitted (17%) and intruded (8.6%) • Cheese pie was most often correctly reported for snack at school (15.8%), but also most often an intrusion for snacks at school (7.9%). • Milk was the most often intruded item for breakfast (5.3%)
Wallace	1 day	Children were served pre-weighed lunch and snacks at the research centre. Dinner was	• Direct observation of school lunch, snacks, and dinner • Web-based self-administered 24-	• Milk was overestimated at lunch and dinner and had the greatest difference between true and reported intakes (average difference of -75.6g and 91.2g)

		served for children and parents family-style. Children were served separately from parents and communal dishes were weighed after serving to determine food weight. Leftovers were weighed to determine intakes	hour dietary recall the next day	• Rice, and salmon were overestimated by around double the true intake, and broccoli was overestimated by 3 times the true intake
Bennett	14 days	N/A	Two 24-hour dietary recalls 2 weeks apart, on each occasion, one interviewer-administered and one self-administered via an app recalling for the same day	• Nuts, herbs and seeds (32% diff), and potatoes and potatoes dishes (12% diff) were over-reported in self-administered vs interviewer-administered • Vegetables and vegetable dishes (10% diff), and creams, ice creams and desserts (28% diff) were under-reported in self-administered vs interviewer-administered
Lucassen	4 weeks	N/A	Participants completed three 2-hour recall days and three 24-hour recall days	The 24-hour dietary recalls tended to over-estimate 'alcoholic beverages' and 'grains and cereals', and under-estimate 'non-alcoholic beverages' and 'nuts, seeds, and snacks' compared to the 2-hour recall app
Söderström	3 days	N/A	• Three, web-based self-administered 24-hour dietary recalls (2 consecutive days and 1 randomly assigned 2-7 days later) • Three, interviewer-administered 24-hour dietary recalls on the same days	No difference in reported intake of food groups (red meat, processed meat, sweet and savory treats, sugar sweetened beverages, artificially sweetened beverages, fruit juice, fruit and vegetables, fish and shellfish, nuts and seeds)

Annexe 2. Food Groups by Level of Confidence

Table 7. Food groups by level of confidence in direct comparison between national surveys using Intake24 and Worldpanel FSS Subset data.

Level	Comparison Food Group	Worldpanel FSS Subset	Intake24
High	Wine	Wine (market) Sparling wine (market) Fortified wines (market)	WINE (48A) FORTIFIED WINE (48B) LOW ALCOHOL AND ALCOHOL FREE WINE (48C)
High	Spirits	Spirits (market)	LIQUEURS (47A) SPIRITS (47B)
High	Beer+Lager	Beer+Lager (market)	BEERS AND LAGERS (49A)
High	Cider	Cider (market)	CIDER AND PERRY (49C) LOW ALCOHOL & ALCOHOL FREE CIDER & PERRY (49D)
High	Non Alcoholic Beer	Non Alcoholic Beer (market)	LOW ALCOHOL & ALCOHOL FREE BEER & LAGER (49B)
High	Milk[1]	Total Milk (market)	WHOLE MILK (10R) SEMI SKIMMED MILK (11R) SKIMMED MILK (12R) 1% Fat Milk (60R) toddler milks (13A) toddler milks dairy free (13A_DF) oat milk (13R_DF)
High	Cheese[2]	Total Cheese (market)	COTTAGE CHEESE (14A) CHEDDAR CHEESE (14B) OTHER CHEESE (14R) cheese dairy free (14R_DF)
High	Yoghurt	Yoghurt (market)	YOGURT (15B) YOGURT DAIRY FREE (15B_DF)
High	Butter	Butter (market)	BUTTER (INCLUDING SPREADABLE BUTTER) (17R)
High	Margarine, lard, cooking oil	Margarine (market) Lards+Compounds (market)	POLYUNSATURATED MARGARINE (18A) POLYUNSATURATED LOW FAT SPREAD (19A) LOW FAT SPREAD NOT POLYUNSATURATED (19R) BLOCK MARGARINE (20A) SOFT MARGARINE NOT POLYUNSATURATED (20B) REDUCED FAT SPREAD (POLYUNSATURATED) (21A) REDUCED FAT SPREAD (NOT POLYUNSATURATED) (21B) POLYUNSATURATED OILS (18B) OTHER COOKING FATS AND OILS NOT PUFA (20C)

High	Soft Drinks, diet	Soft Drinks Diet (excl. water)	SOFT DRINKS LOW CALORIE CONCENTRATED (58A) SOFT DRINKS LOW CALORIE CARBONATED (58B) SOFT DRINKS LOW CALORIE RTD STILL (58C)
High	Confectionery	Take Home Confectionery (sector)	SUGAR CONFECTIONERY (43R) CHOCOLATE CONFECTIONERY (44R)
High	Biscuits	Biscuits (sector)	BISCUITS MANUFACTURED / RETAIL (7A) Toddler cereal bar (52R)
High	Fruit[3]	Fruit (market)	APPLES AND PEARS NOT CANNED (40A) CITRUS FRUIT NOT CANNED (40B) BANANAS (40C) OTHER FRUIT NOT CANNED (40R)
Medium	Eggs	Eggs (market)	EGG PRODUCTS - MANUFACTURED (16C) OTHER EGGS AND EGG DISHES INCLUDING HOMEMADE (16D)
Medium	Fresh Cream[4]	Fresh Cream (market)	CREAM (INCLUDING IMITATION CREAM) (13B) DAIRY FREE CREAM (13B_DF)
Medium	Cakes and pastries	Ambient Cakes+Pastries (market) Morning Goods (market) Chilled Bakery Products (sector)	FRUIT PIES MANUFACTURED (8B) BUNS CAKES & PASTRIES MANUFACTURED (8D)
Medium	Bread	Total Bread (market)	WHITE BREAD (NOT HIGH FIBRE; NOT MULTISEED BREAD) (2R) WHOLEMEAL BREAD (3R) BROWN GRANARY AND WHEATGERM BREAD (59R) OTHER BREAD (4R)
Medium	Soft Drinks[5]	Soft Drinks Regular (excl. water)	SOFT DRINKS NOT LOW CALORIE CONCENTRATED (57A) SOFT DRINKS NOT LOW CALORIE CARBONATED (57B) SOFT DRINKS NOT LOW CALORIE RTD STILL (57C) FRUIT JUICE (45R)

Low	Ready Meals[6]	Chilled Ready Meals (market)	PASTA MANUFACTURED PRODUCTS & READY MEALS (1D) RICE MANUFACTURED PRODUCTS & READY MEALS (1F) READY MEALS / MEAL CENTRES BASED ON BACON AND HAM (22A) MANUFACTURED BEEF PRODUCTS INCLUDING READY MEALS (23A) MANUFACTURED LAMB PRODUCTS INCLUDING READY MEALS (24A) MANUFACTURED PORK PRODUCTS INCLUDING READY MEALS (25A) MANUFACTURED CHICKEN PRODUCTS INCL READY MEALS (27A)*** READY MEALS BASED ON SAUSAGES (30A) BEANS AND PULSES INCL READY MEAL & HOMEMADE DISHES (37I)*** MEAT ALTERNATIVES INCL READY MEALS & HOMEMADE DISH (37K)*** OTHER MANUFACTURED VEGETABLE PRODUCTS INCL RM (37L)
Low	Meat[7,8]	Cooked Meats (market) Chilled Burgers+Grills (market) Fresh Other Meat & Offal (market) Frozen Meat (sector) Chilled Pate+Paste+Spread (market) P/P Fresh Meat+Veg+Pastry (market) Lse Fresh Meat & Pastry (market)	OTHER BACON AND HAM INCLUDING HOMEMADE DISHES (22B) OTHER BEEF & VEAL INCLUDING HOMEMADE RECIPE DISHES (23B) OTHER LAMB INCLUDING HOMEMADE RECIPE DISHES (24B) OTHER PORK INCLUDING HOMEMADE RECIPE DISHES (25B) OTHER SAUSAGES INCLUDING HOMEMADE DISHES (30B) MANUFACTURED MEAT PIES AND PASTRIES (31A) HOMEMADE MEAT PIES AND PASTRIES (31B) BURGERS AND KEBABS PURCHASED (29R) Other meat and meat products (32A) Other meat and meat products (32B) LIVER AND DISHES (28R)
Low	Desserts[9]	Chilled Desserts (market) Fromage Frais (market)	FROMAGE FRAIS AND DAIRY DESSERTS MANUFACTURED (15C) FROMAGE FRAIS AND DAIRY DESSERTS MANUFACTURED dairy free (15C_DF) CEREAL BASED MILK PUDDINGS - MANUFACTURED (9C) SPONGE PUDDINGS - MANUFACTURED (9E) OTHER CEREAL BASED PUDDINGS - MANUFACTURED (9G)

Low	Pizza and bases[10]	Chilled Pizza+Bases (market)	PIZZA (1C)
Low	Soup[11]	Fresh Soup (market)	SOUP MANUFACTURED/ RETAIL (50C)
Low	Vegetables[12]	Vegetable (market) Chilled Prepared Salad (market)	CARROTS RAW (36A) SALAD AND OTHER RAW VEGETABLES (36B) TOMATOES RAW (36C) GREEN BEANS NOT RAW (37B) LEAFY GREEN VEGETABLES NOT RAW (37D) CARROTS NOT RAW (37E) TOMATOES NOT RAW (37F)
Low	Nuts[13]	Nuts (market)	NUTS AND SEEDS (56R)
Low	Yoghurt drinks, smoothies, milkshakes	Yoghurt Drinks And Juices (market) Chilled Drinks (sector)	SMOOTHIES 100% FRUIT AND/OR JUICE (61R) milkshake ready to drink (13R)
Low	Poultry and game[7,14]	Fresh Poultry+Game (sector) Frozen Poultry+Game (sector) Chilled Processed Poultry (market)	MANUFACTURED COATED CHICKEN / TURKEY PRODUCTS (26A)*** MANUFACTURED CHICKEN PRODUCTS INCL READY MEALS (27A) *** OTHER CHICKEN / TURKEY INCL HOMEMADE RECIPE DISHES (27B)
Low	Crisps[15]	Take Home Savouries (sector)	CRISPS AND SAVOURY SNACKS (42R)
Low	Fish[7]	Fresh Fish (sector) Frozen Fish (sector)	MANUFACTURED WHITE FISH PRODUCTS INCL READY MEALS (34C) OTHER WHITE FISH INCLUDING HOMEMADE DISHES (34D) MANUFACTURED SHELLFISH PRODUCTS INCL READY MEALS (34E) OTHER SHELLFISH INCLUDING HOMEMADE DISHES (34F) MANUFACTURED CANNED TUNA PRODUCTS INCL READY MEALS (34G) OTHER CANNED TUNA INCLUDING HOMEMADE DISHES (34H) MANUFACTURED OILY FISH PRODUCTS INCL READY MEALS (35A)

			WHITE FISH COATED OR FRIED (33R) OTHER OILY FISH INCLUDING HOMEMADE DISHES (35B)
Low	Frozen confectionery and ice cream[16]	Frozen Confectionery (sector)	ICE CREAM (53R) dairy free ice cream (53R_DF)
Low	Sauces and condiments[17]	Pickle+Tbl Sce+Condiment (sector) Chilled Gravy+Stock (market)	SAVOURY SAUCES PICKLES GRAVIES & CONDIMENTS (50R)
Low	Dry noodles and rice[18]	Savoury Carbohydrts+Sncks (sector) Fresh Pasta (market) Chilled rice (market)	OTHER PASTA INCLUDING HOMEMADE DISHES (1E) OTHER RICE INCLUDING HOMEMADE DISHES (1G) OTHER CEREALS (1R)
Cannot compare	Flavoured alcoholic beverages	Fabs (market)	ALCOHOLIC SOFT DRINK (49E)
Cannot compare	Other convenience	Other Chilled Convenience (market) Chilled Dips (market) Chilled Vegetarian (market) Chilled Vegetarian (market) Chld Sandwich Fillers (market) Chilled Olives (market) Chilled Cooking Sauces (market) Fresh/Chilled Pastry (market) Chilled Salad Accomps (market)	
Cannot compare	Frozen prepared foods[19]	Frozen Prepared Foods (sector)	CHIPS PURCHASED INCLUDING TAKEAWAY (38A) OTHER MANUFACTURED POTATO PRODUCTS FRIED/BAKED (38C) OTHER FRIED / ROAST POTATOES INCL HOMEMADE DISHES (38D) OTHER POTATO PRODUCTS & DISHES - MANUFACTURED (39A) OTHER POTATOES INCLUDING HOMEMADE DISHES (39B)

Cannot compare	Tea and coffee[20]	Hot Beverages (sector)	COFFEE (51A) TEA (51B) HERBAL TEA (MADE-UP WEIGHT) (51C) BOTTLED WATER STILL OR CARBONATED (51D) TAP WATER ONLY (51R) Hot chocolate, made with water (50A)
Cannot compare	Packet breakfast[20]	Packet Breakfast (sector)	PRESERVES (41B) HIGH FIBRE BREAKFAST CEREALS (5R) OTHER BREAKFAST CEREALS (NOT HIGH FIBRE) (6R)
Cannot compare	Sweet home baking	Sweet Home Cooking (sector)	SUGAR (41A) ARTIFICIAL SWEETENERS (55R) SWEET SPREADS FILLINGS AND ICING (41R)
Cannot compare	Ambient slimming products	Ambient Slimming Products (sector)	NUTRITION POWDERS AND DRINKS (50E)
Cannot compare	Canned goods[19]	Canned Goods (sector)	CANNED FRUIT IN JUICE (40D) CANNED FRUIT IN SYRUP (40E) BAKED BEANS (37C)
Cannot compare	Savoury home cooking	Savoury Home Cooking (sector)	

[1] Worldpanel FSS Subset missing condensed and evaporated and instant milk markets from sweet home cooking sector and 'chilled flavoured milk' from chilled drinks sector and ambient flavoured milk from take home soft drinks sector (take home soft drinks sector not in Worldpanel FSS Subset data).
[2] Intake24 missing cheese in mixed dishes.
[3] Worldpanel FSS Subset missing fruit from Chilled and prepared fruit and veg market.
[4] Worldpanel FSS Subset missing 'canned cream' from sweet home cooking sector.
[5] Intake24 includes all fruit juice whereas Worldpanel FSS Subset is only ambient fruit juice (chilled fruit juice is in 'chilled drinks').
[6] Intake24 includes homemade meals. Worldpanel FSS Subset missing frozen ready meals market (from frozen prepared foods sector).
[7] Intake24 is total weight of mixed dishes containing meat, poultry and game.
[8] Worldpanel FSS Subset missing 'canned meats' (market in canned goods sector) and frozen meat (market in frozen prepared foods sector).
[9] Worldpanel FSS Subset missing 'frozen confectionery' market from frozen confectionary sector.
[10] Worldpanel FSS Subset missing 'Frozen pizza' (market in 'Frozen prepared foods' (sector)) and missing 'ambient pizza bases market (savoury home cooking sector).
[11] Worldpanel FSS Subset missing 'ambient soup' (market in canned goods sector).
[12] Worldpanel FSS Subset missing 'Canned vegetables (market in canned goods sector) and frozen vegetables (market in frozen prepared foods sector). Worldpanel FSS Subset missing veg from Chilled and prepared fruit and veg market.
[13] Worldpanel FSS Subset missing 'nuts' market from sweet home cooking sector and nuts market from take home savouries sector.
[14] Worldpanel FSS Subset missing frozen poultry (market in frozen prepared foods sector).
[15] Worldpanel FSS Subset sector includes crisps, popcorn, nuts. Would require market level data to compare appropriately.
[16] Would require market level data from Worldpanel by Numerator for more confidence in comparison.
[17] Sauces and condiments are in many different markets and sectors in Worldpanel FSS Subset and minimally reported in intake24.
[18] Intake24 does not contain dry products, these items would be in mixed dishes.
[19] Intake24 does not distinguish between frozen, canned or fresh for most foods.

[20] Intake24 is weight as consumed (with water).

Annexe 3. Census Data

Table 8. Population size by age group and sex from the Scottish Census (Scottish Government, 2022a).

Age Group	Female	Male
2-4y	74835	79132
5-10y	166588	175886
11-15y	146969	153398
16-24y	290999	291487
25-34y	354753	339421
35-44y	349530	331243
45-54y	371024	349144
55-64y	401481	378917
65-74y	312548	287378
75+y	282635	208040

Annexe 4. Intakes by Comparison Food Group

Compare Confidence: High

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Beer and Lager	carbs_g	443,956	16%	16%	2,529,971	2,973,927
high	Beer and Lager	energy_kcal	14,755,475,545	39%	39%	30,253,304,455	45,008,780,000
high	Beer and Lager	fat_g	894	200%	200%	0	894
high	Beer and Lager	fibre_g	183	200%	200%	0	183
high	Beer and Lager	satfat_g	829	200%	200%	0	829
high	Beer and Lager	sodium_mg	-5,350,695	120%	-120%	7,119,695	1,769,000
high	Beer and Lager	totalsugars_g	-1,733,849	104%	-104%	2,529,971	796,122

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Biscuits	carbs_g	20,305,690	62%	62%	22,572,130	42,877,820
high	Biscuits	energy_kcal	165,956,102,955	72%	72%	147,886,697,045	313,842,800,000
high	Biscuits	fat_g	7,423,735	77%	77%	5,962,375	13,386,110
high	Biscuits	fibre_g	786,740	42%	42%	1,470,254	2,256,994

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Biscuits	satfat_g	3,734,640	82%	82%	2,714,304	6,448,944
high	Biscuits	sodium_mg	113,297,997	76%	76%	91,663,003	204,961,000
high	Biscuits	totalsugars_g	10,112,952	79%	79%	7,735,358	17,848,310

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Butter	carbs_g	137,135	123%	123%	43,355	180,490
high	Butter	energy_kcal	98,992,980,320	101%	101%	48,617,719,680	147,610,700,000
high	Butter	fat_g	10,901,113	101%	101%	5,366,087	16,267,200
high	Butter	fibre_g	34,147	164%	164%	3,706	37,853
high	Butter	satfat_g	4,792,285	85%	85%	3,220,847	8,013,132
high	Butter	sodium_mg	57,051,488	101%	101%	27,728,512	84,780,000
high	Butter	totalsugars_g	85,303	104%	104%	39,340	124,643

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Cheese	carbs_g	837,550	95%	95%	461,928	1,299,478
high	Cheese	energy_kcal	94,184,776,425	87%	87%	60,559,323,575	154,744,100,000

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Cheese	fat_g	7,444,945	87%	87%	4,800,565	12,245,510
high	Cheese	fibre_g	86,948	123%	123%	27,196	114,144
high	Cheese	satfat_g	4,608,462	87%	87%	3,007,558	7,616,020
high	Cheese	sodium_mg	173,948,687	87%	87%	112,596,313	286,545,000
high	Cheese	totalsugars_g	368,606	90%	90%	225,462	594,068

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Cider	carbs_g	1,248,018	150%	150%	207,089	1,455,107
high	Cider	energy_kcal	11,575,593,395	136%	136%	2,737,566,605	14,313,160,000
high	Cider	fat_g	290	200%	200%	0	290
high	Cider	fibre_g	109	200%	200%	0	109
high	Cider	satfat_g	265	200%	200%	0	265
high	Cider	sodium_mg	2,467,726	141%	141%	510,274	2,978,000
high	Cider	totalsugars_g	1,179,675	148%	148%	207,089	1,386,764

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Confectionery	carbs_g	27,649,458	102%	102%	13,171,362	40,820,820
high	Confectionery	energy_kcal	181,195,824,090	96%	96%	97,783,475,910	278,979,300,000
high	Confectionery	fat_g	6,655,262	82%	82%	4,822,318	11,477,580
high	Confectionery	fibre_g	599,326	72%	72%	538,016	1,137,342
high	Confectionery	satfat_g	3,979,745	86%	86%	2,650,985	6,630,730
high	Confectionery	sodium_mg	40,949,484	102%	102%	19,845,516	60,795,000
high	Confectionery	totalsugars_g	22,106,820	97%	97%	11,733,000	33,839,820

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Fruit	carbs_g	2,678,987	10%	10%	26,238,033	28,917,020
high	Fruit	energy_kcal	12,405,388,280	10%	10%	115,873,311,720	128,278,700,000
high	Fruit	fat_g	-502,888	52%	-52%	1,214,790	711,902
high	Fruit	fibre_g	-23,823	1%	-1%	3,022,729	2,998,906
high	Fruit	satfat_g	55,114	19%	19%	255,453	310,567
high	Fruit	sodium_mg	-11,459,246	106%	-106%	16,534,246	5,075,000
high	Fruit	totalsugars_g	2,489,958	10%	10%	24,869,372	27,359,330

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Margarine, lard, cooking oil	carbs_g	110,682	141%	141%	23,365	134,047
high	Margarine, lard, cooking oil	energy_kcal	65,378,600,195	123%	123%	20,657,268,805	86,035,869,000
high	Margarine, lard, cooking oil	fat_g	7,191,657	122%	122%	2,307,270	9,498,927
high	Margarine, lard, cooking oil	fibre_g	31,623	135%	135%	7,653	39,276
high	Margarine, lard, cooking oil	satfat_g	2,129,630	127%	127%	613,173	2,742,803
high	Margarine, lard, cooking oil	sodium_mg	65,068,587	132%	132%	16,741,413	81,810,000
high	Margarine, lard, cooking oil	totalsugars_g	60,455	161%	161%	7,243	67,698

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Milk	carbs_g	14,442,252	81%	81%	10,636,768	25,079,020
high	Milk	energy_kcal	153,156,984,090	78%	78%	118,798,715,910	271,955,700,000

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Milk	fat_g	5,760,525	72%	72%	5,137,325	10,897,850
high	Milk	fibre_g	162,745	143%	143%	32,122	194,867
high	Milk	satfat_g	3,503,959	72%	72%	3,138,105	6,642,064
high	Milk	sodium_mg	130,350,815	78%	78%	102,935,185	233,286,000
high	Milk	totalsugars_g	14,245,593	81%	81%	10,455,567	24,701,160

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Non Alcoholic Beer	carbs_g	97,695	90%	90%	59,144	156,839
high	Non Alcoholic Beer	energy_kcal	388,664,469	83%	83%	276,101,231	664,765,700
high	Non Alcoholic Beer	fat_g	214	200%	200%	0	214
high	Non Alcoholic Beer	fibre_g	0			0	0
high	Non Alcoholic Beer	satfat_g	172	200%	200%	0	172
high	Non Alcoholic Beer	sodium_mg	18,119	21%	21%	78,881	97,000
high	Non Alcoholic Beer	totalsugars_g	-10,760	20%	-20%	59,144	48,384

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Soft Drinks, diet	carbs_g	-628,704	103%	-103%	922,438	293,734
high	Soft Drinks, diet	energy_kcal	-2,025,266,326	51%	-51%	5,017,927,326	2,992,661,000
high	Soft Drinks, diet	fat_g	4,573	200%	200%	0	4,573
high	Soft Drinks, diet	fibre_g	38,227	193%	193%	648	38,875
high	Soft Drinks, diet	satfat_g	714	200%	200%	0	714
high	Soft Drinks, diet	sodium_mg	-4,219,799	23%	-23%	20,266,799	16,047,000
high	Soft Drinks, diet	totalsugars_g	-677,049	117%	-117%	919,137	242,088

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Spirits	carbs_g	892,832	186%	186%	33,424	926,256
high	Spirits	energy_kcal	63,860,070,500	160%	160%	7,980,769,500	71,840,840,000
high	Spirits	fat_g	95,665	200%	200%	0	95,665
high	Spirits	fibre_g	0			0	0
high	Spirits	satfat_g	38,770	200%	200%	0	38,770
high	Spirits	sodium_mg	4,096,171	194%	194%	59,829	4,156,000
high	Spirits	totalsugars_g	826,259	185%	185%	33,424	859,683

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Wine	carbs_g	527,351	69%	69%	501,872	1,029,223
high	Wine	energy_kcal	34,969,906,110	65%	65%	36,649,790,890	71,619,697,000
high	Wine	fat_g	1,522	200%	200%	0	1,522
high	Wine	fibre_g	104	200%	200%	0	104
high	Wine	satfat_g	1,211	200%	200%	0	1,211
high	Wine	sodium_mg	5,577,561	96%	96%	3,009,439	8,587,000
high	Wine	totalsugars_g	466,895	63%	63%	501,872	968,767

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Yoghurt	carbs_g	533,253	10%	10%	5,187,455	5,720,708
high	Yoghurt	energy_kcal	6,240,732,070	13%	13%	44,288,837,930	50,529,570,000
high	Yoghurt	fat_g	-15,203	1%	-1%	1,779,018	1,763,815
high	Yoghurt	fibre_g	51,549	37%	37%	114,810	166,359
high	Yoghurt	satfat_g	-61,031	5%	-5%	1,162,983	1,101,952
high	Yoghurt	sodium_mg	6,686,144	21%	21%	28,328,856	35,015,000

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
high	Yoghurt	totalsugars_g	307,892	6%	6%	4,800,740	5,108,632

Compare Confidence: Medium

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
medium	Bread	carbs_g	-284,849	1%	-1%	50,828,039	50,543,190

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
medium	Bread	energy_kcal	22,388,394,895	8%	8%	265,431,605,105	287,820,000,000
medium	Bread	fat_g	-439,150	12%	-12%	4,004,795	3,565,645
medium	Bread	fibre_g	135,359	3%	3%	4,624,690	4,760,049
medium	Bread	satfat_g	-361,076	40%	-40%	1,078,434	717,358
medium	Bread	sodium_mg	55,167,186	14%	14%	379,452,814	434,620,000
medium	Bread	totalsugars_g	275,471	7%	7%	3,694,825	3,970,296

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
medium	Cakes and pastries	carbs_g	52,547,409	137%	137%	12,055,752	64,603,161
medium	Cakes and pastries	energy_kcal	318,764,235,765	131%	131%	83,882,124,235	402,646,360,000
medium	Cakes and pastries	fat_g	8,058,631	104%	104%	3,722,298	11,780,929
medium	Cakes and pastries	fibre_g	3,196,372	153%	153%	496,884	3,693,256
medium	Cakes and pastries	satfat_g	3,012,654	97%	97%	1,605,715	4,618,369
medium	Cakes and pastries	sodium_mg	346,173,276	154%	154%	51,636,724	397,810,000
medium	Cakes and pastries	totalsugars_g	12,539,804	107%	107%	5,418,068	17,957,872

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
medium	Eggs	carbs_g	260,834	138%	138%	58,736	319,570
medium	Eggs	energy_kcal	11,663,214,355	24%	24%	43,692,205,645	55,355,420,000
medium	Eggs	fat_g	537,500	15%	15%	3,433,759	3,971,259
medium	Eggs	fibre_g	52,117	199%	199%	191	52,308
medium	Eggs	satfat_g	-204,383	17%	-17%	1,299,418	1,095,035
medium	Eggs	sodium_mg	-43,762,806	54%	-54%	103,679,806	59,917,000
medium	Eggs	totalsugars_g	81,982	91%	91%	49,064	131,046

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
medium	Fresh Cream	carbs_g	390,001	157%	157%	52,778	442,779
medium	Fresh Cream	energy_kcal	32,092,507,542	139%	139%	6,975,542,458	39,068,050,000
medium	Fresh Cream	fat_g	3,324,427	139%	139%	733,536	4,057,963
medium	Fresh Cream	fibre_g	8,790	200%	200%	0	8,790
medium	Fresh Cream	satfat_g	2,011,938	137%	137%	461,868	2,473,806
medium	Fresh Cream	sodium_mg	3,954,397	154%	154%	594,603	4,549,000
medium	Fresh Cream	totalsugars_g	356,916	155%	155%	52,136	409,052

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
medium	Soft Drinks	carbs_g	330,388	2%	2%	14,136,322	14,466,710
medium	Soft Drinks	energy_kcal	6,342,770,765	11%	11%	55,192,029,235	61,534,800,000
medium	Soft Drinks	fat_g	95,024	173%	173%	7,519	102,543
medium	Soft Drinks	fibre_g	111,193	99%	99%	56,262	167,455
medium	Soft Drinks	satfat_g	39,911	188%	188%	1,254	41,165
medium	Soft Drinks	sodium_mg	23,077,603	104%	104%	10,599,397	33,677,000
medium	Soft Drinks	totalsugars_g	-144,746	1%	-1%	13,862,646	13,717,900

Compare Confidence: Low

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Crisps	carbs_g	8,285,881	52%	52%	11,665,439	19,951,320
low	Crisps	energy_kcal	104,694,754,260	73%	73%	91,802,345,740	196,497,100,000
low	Crisps	fat_g	6,349,078	78%	78%	4,934,992	11,284,070
low	Crisps	fibre_g	831,943	70%	70%	778,832	1,610,775

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Crisps	satfat_g	851,712	97%	97%	456,275	1,307,987
low	Crisps	sodium_mg	117,565,284	74%	74%	101,004,716	218,570,000
low	Crisps	totalsugars_g	1,014,484	96%	96%	548,909	1,563,393

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Desserts	carbs_g	2,754,840	96%	96%	1,500,513	4,255,353
low	Desserts	energy_kcal	22,728,986,815	101%	101%	11,036,603,185	33,765,590,000
low	Desserts	fat_g	1,048,272	105%	105%	474,451	1,522,723
low	Desserts	fibre_g	137,011	126%	126%	40,374	177,385
low	Desserts	satfat_g	645,251	107%	107%	278,837	924,088
low	Desserts	sodium_mg	9,727,916	104%	104%	4,534,084	14,262,000
low	Desserts	totalsugars_g	2,022,255	94%	94%	1,140,664	3,162,919

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Dry noodles and rice	carbs_g	3,679,379	22%	22%	14,558,061	18,237,440
low	Dry noodles and rice	energy_kcal	17,821,080,615	20%	20%	81,109,624,385	98,930,705,000
low	Dry noodles and rice	fat_g	-733,168	44%	-44%	2,030,961	1,297,793

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Dry noodles and rice	fibre_g	572,254	62%	62%	636,995	1,209,249
low	Dry noodles and rice	satfat_g	-228,219	43%	-43%	641,633	413,414
low	Dry noodles and rice	sodium_mg	9,085,468	19%	19%	43,207,532	52,293,000
low	Dry noodles and rice	totalsugars_g	128,191	22%	22%	527,671	655,862

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Fish	carbs_g	-644,891	27%	-27%	2,672,683	2,027,792
low	Fish	energy_kcal	-17,603,953,800	38%	-38%	55,125,263,800	37,521,310,000
low	Fish	fat_g	-1,136,942	48%	-48%	2,912,760	1,775,818
low	Fish	fibre_g	-90,572	48%	-48%	233,962	143,390
low	Fish	satfat_g	-259,613	64%	-64%	535,287	275,674
low	Fish	sodium_mg	-6,356,631	8%	-8%	86,770,631	80,414,000
low	Fish	totalsugars_g	-52,114	25%	-25%	233,563	181,449

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Frozen confectionery and ice cream	carbs_g	8,622,589	130%	130%	2,301,781	10,924,370
low	Frozen confectionery and ice cream	energy_kcal	68,209,319,580	129%	129%	18,671,760,420	86,881,080,000
low	Frozen confectionery and ice cream	fat_g	3,218,735	124%	124%	977,404	4,196,139
low	Frozen confectionery and ice cream	fibre_g	326,536	142%	142%	67,384	393,920
low	Frozen confectionery and ice cream	satfat_g	2,178,358	123%	123%	681,198	2,859,556
low	Frozen confectionery and ice cream	sodium_mg	20,512,571	129%	129%	5,677,429	26,190,000
low	Frozen confectionery and ice cream	totalsugars_g	6,451,498	126%	126%	1,912,231	8,363,729

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Meat	carbs_g	-317,501	4%	-4%	8,646,606	8,329,105

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Meat	energy_kcal	129,123,330,235	53%	53%	179,789,422,765	308,912,753,000
low	Meat	fat_g	8,458,244	58%	58%	10,402,367	18,860,611
low	Meat	fibre_g	-61,036	6%	-6%	984,103	923,067
low	Meat	satfat_g	3,309,102	57%	57%	4,180,884	7,489,986
low	Meat	sodium_mg	424,002,583	75%	75%	352,201,417	776,204,000
low	Meat	totalsugars_g	-1,871	0%	0%	1,282,627	1,280,756

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Nuts	carbs_g	-459,487	71%	-71%	881,366	421,879
low	Nuts	energy_kcal	-24,946,053,875	88%	-88%	40,939,193,875	15,993,140,000
low	Nuts	fat_g	-2,220,090	91%	-91%	3,556,131	1,336,041
low	Nuts	fibre_g	-378,227	104%	-104%	554,449	176,222
low	Nuts	satfat_g	-375,354	98%	-98%	572,165	196,811
low	Nuts	sodium_mg	-11,836,246	163%	-163%	13,187,246	1,351,000
low	Nuts	totalsugars_g	-151,788	46%	-46%	402,369	250,581

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Pizza and bases	carbs_g	-4,939,540	89%	-89%	8,022,903	3,083,363
low	Pizza and bases	energy_kcal	-37,825,142,605	85%	-85%	63,277,632,605	25,452,490,000
low	Pizza and bases	fat_g	-1,442,932	89%	-89%	2,346,617	903,685
low	Pizza and bases	fibre_g	-181,255	55%	-55%	418,023	236,768
low	Pizza and bases	satfat_g	-615,773	89%	-89%	996,836	381,063
low	Pizza and bases	sodium_mg	-58,645,328	84%	-84%	99,346,328	40,701,000
low	Pizza and bases	totalsugars_g	-631,117	90%	-90%	1,018,389	387,272

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Poultry and game	carbs_g	-2,158,820	89%	-89%	3,510,973	1,352,153
low	Poultry and game	energy_kcal	12,715,795,525	12%	12%	97,778,833,475	110,494,629,000
low	Poultry and game	fat_g	571,603	13%	13%	3,984,540	4,556,143
low	Poultry and game	fibre_g	-304,339	94%	-94%	477,610	173,271
low	Poultry and game	satfat_g	327,973	31%	31%	889,485	1,217,458
low	Poultry and game	sodium_mg	2,575,832	2%	2%	102,929,168	105,505,000
low	Poultry and game	totalsugars_g	-393,134	81%	-81%	682,185	289,051

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Ready Meals	carbs_g	3,949,135	68%	68%	3,843,631	7,792,766
low	Ready Meals	energy_kcal	58,294,508,645	101%	101%	28,303,971,355	86,598,480,000
low	Ready Meals	fat_g	2,740,893	112%	112%	1,072,226	3,813,119
low	Ready Meals	fibre_g	561,456	93%	93%	325,527	886,983
low	Ready Meals	satfat_g	946,753	106%	106%	422,265	1,369,018
low	Ready Meals	sodium_mg	95,434,948	102%	102%	46,174,052	141,609,000
low	Ready Meals	totalsugars_g	995,303	107%	107%	433,486	1,428,789

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Sauces and condiments	carbs_g	2,454,100	63%	63%	2,641,063	5,095,163
low	Sauces and condiments	energy_kcal	32,657,287,990	68%	68%	31,554,634,710	64,211,922,700
low	Sauces and condiments	fat_g	2,347,687	69%	69%	2,221,537	4,569,224
low	Sauces and condiments	fibre_g	225,554	83%	83%	157,677	383,231
low	Sauces and condiments	satfat_g	22,378	5%	5%	423,889	446,267

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Sauces and condiments	sodium_mg	67,820,554	40%	40%	135,699,446	203,520,000
low	Sauces and condiments	totalsugars_g	2,432,608	79%	79%	1,870,240	4,302,848

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Soup	carbs_g	-534,657	104%	-104%	781,896	247,239
low	Soup	energy_kcal	-2,951,577,032	79%	-79%	5,206,313,032	2,254,736,000
low	Soup	fat_g	-84,609	65%	-65%	171,888	87,279
low	Soup	fibre_g	-6,218	10%	-10%	65,717	59,499
low	Soup	satfat_g	-30,096	61%	-61%	64,298	34,202
low	Soup	sodium_mg	-21,452,898	109%	-109%	30,380,898	8,928,000
low	Soup	totalsugars_g	-186,995	97%	-97%	287,182	100,187

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Vegetables	carbs_g	26,105,055	141%	141%	5,443,103	31,548,158
low	Vegetables	energy_kcal	136,972,886,350	118%	118%	47,958,083,650	184,930,970,000
low	Vegetables	fat_g	1,571,516	51%	51%	2,282,417	3,853,933
low	Vegetables	fibre_g	3,523,608	87%	87%	2,302,958	5,826,566
low	Vegetables	satfat_g	209,822	41%	41%	400,760	610,582
low	Vegetables	sodium_mg	13,467,964	28%	28%	40,997,036	54,465,000
low	Vegetables	totalsugars_g	4,445,728	71%	71%	4,024,211	8,469,939

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Yoghurt drinks, juice, smoothies, milkshakes	carbs_g	2,961,812	49%	49%	4,610,962	7,572,774
low	Yoghurt drinks, juice, smoothies, milkshakes	energy_kcal	8,043,614,385	24%	24%	28,896,557,615	36,940,172,000
low	Yoghurt drinks, juice, smoothies, milkshakes	fat_g	-526,106	102%	-102%	780,914	254,808
low	Yoghurt drinks, juice, smoothies, milkshakes	fibre_g	-147,747	56%	-56%	338,959	191,212

compconf	Group	Nutrient	Difference	% Difference (absolute)	% Difference	Intake24	Worldpanel FSS Subset
low	Yoghurt drinks, juice, smoothies, milkshakes	satfat_g	-278,190	100%	-100%	416,764	138,574
low	Yoghurt drinks, juice, smoothies, milkshakes	sodium_mg	-12,942,903	82%	-82%	22,287,903	9,345,000
low	Yoghurt drinks, juice, smoothies, milkshakes	totalsugars_g	2,958,137	52%	52%	4,244,760	7,202,897