

School food menu analysis to assess the adherence of primary schools to the School Food Standards in England

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Abstract

Background

School meals contribute to children's daily dietary intake in England, yet evidence of compliance with the statutory School Food Standards (SFS) remains limited and geographically constrained. Scalable approaches to monitoring compliance are needed to better understand how consistently these standards are implemented across schools and contexts.

Methods

A cross-sectional study was conducted using publicly available lunch menus from state-funded primary schools across three regions of England ($n = 105$). A structured menu interpretation framework was applied to assess compliance with the 22 SFS via a binary scoring system. Overall compliance was calculated as the percentage of standards met. Descriptive analyses were used to examine variation by region and food group. Associations between compliance and school characteristics, including deprivation (Index of Multiple Deprivation [IMD], Income Deprivation Affecting Children Index [IDACI]), the proportion of pupils eligible for free school meals (FSM), and the type of food provision, were explored via Tobit regression models to account for the bounded nature of the outcome (0–1).

Results

The mean compliance with the SFS was 66% (SD 8.3), indicating moderate but incomplete adherence. Most schools (91%) were classified as mostly compliant, whereas only 8% met the criteria for full compliance. Provision-based standards, particularly those related to fruits, vegetables, and core food groups, consistently showed high adherence. In contrast, lower compliance was observed for restrictive standards related to foods high in fat, sugar, and salt (HFSS), as well as for wholegrain provision and lower fat milk availability. Tobit regression indicated a negative association between the IMD score and compliance ($\beta = -0.013$, $p = 0.007$). External food provision was positively associated with compliance at the 10% significance level ($\beta = 0.029$, $p = 0.017$). No significant association was observed with FSM at the 5% level.

Conclusions

Compliance with the SFS in English primary schools remains incomplete, with consistent differences between provision-based standards and restrictive standards. Deprivation may influence compliance, although relationships appear context dependent. Menu-based analysis offers a feasible and scalable approach for monitoring school food provision, but further research is needed to understand the barriers

to implementing restrictive standards and the role of structural factors such as catering models and procurement systems.

Introduction

This paper examines menu-based compliance with the School Food Standards (SFS) in primary schools in England.

For approximately 2.2 million children in England, school meals constitute a routine part of daily life and constitute up to 30% of daily food intake (1–5). The nutritional quality of these meals therefore plays an important role in shaping children’s diets and long-term health (1, 2, 6). Eating patterns established during childhood often persist into adulthood and are associated with risks of obesity, cardiovascular disease and other chronic conditions (7, 8). Improving the quality of food provided in schools has consequently become a key public health strategy for supporting healthier dietary patterns early in life (9).

In England, the SFS are national standards introduced in 2014 as statutory regulations (legally required rules) for all state-run schools. The purpose of the SFS was to ensure that pupils are provided with a nutritionally balanced diet across the school day from breakfast, lunch, after school and all the food provided within the school setting (9). They were introduced following a 2013 independent review led by Henry Dimbleby and John Vincent, which informed the School Food Plan and aimed to improve school food provision and address childhood obesity, as outlined in the national policy known as “Childhood Obesity: Plan of Action” (9, 10).

The SFS requires schools to provide a range of food groups on daily, weekly, or three-weekly bases. The SFS consists of six food groups: starchy food; fruit and vegetables; nondairy protein; dairy protein; food high in fat, sugar and salt (HFSS); and healthy drinks (9). Within each food group, the standards include provision-based requirements (e.g., daily or weekly inclusion of specific foods) or restrictive requirements, which limit certain food types, preparation methods, and products high in fat, sugar, or salt. By establishing minimum requirements for school food provision, the SFS aims to promote healthier eating environments and reduce inequalities in children’s access to nutritious food (9).

Although the SFS was updated in 2020, it is not fully aligned with more recent dietary guidance, including Public Health England’s Eatwell Guide (2016) and recommendations from the Scientific Advisory Committee on Nutrition (SACN) (11). Despite these limitations, the SFS remains the statutory benchmark for school food provision in England. Understanding whether schools are meeting these standards in practice is therefore essential both to evaluate current implementation and to inform ongoing discussions about their relevance and effectiveness.

Answering this question has proven challenging. Much of the existing research examining school food provision has relied on labor-intensive observational studies or small local samples. Earlier work by (12) and (13), for example, required researchers to visit schools and manually record portion sizes and

ingredients. While these approaches provide detailed insights, they are difficult to apply at scale. In addition, many of these studies predate the introduction of the statutory SFS in 2014 and therefore do not reflect implementation under the current regulatory framework. Other studies have focused on pupils' food choices or dietary intake rather than assessing compliance with the standards themselves (14). While these studies provide important insights into what pupils eat, they do not directly evaluate whether schools are meeting the statutory requirements governing the food that should be provided.

Some more recent evidence exists, but it remains limited. For example, the Food provision, Culture and Environment in Secondary Schools (FUEL) study reported a median compliance rate of 81% for school lunches (3). However, this study focused only on secondary schools in the Midlands and relied on a combination of menu analysis, onsite observations, and additional data collection. As a result, it does not provide a scalable or easily replicable method for assessing compliance across a larger number of schools (5).

Similarly, a government-commissioned pilot study by Kantar Public attempted to develop a practical approach to monitoring compliance through a short set of inspection questions (15). However, this approach was found to be difficult to implement in practice, as food safety officers have limited time during routine inspections. In addition, the tool assessed only a small number of indicators and was not designed to capture the full range of SFS requirements, raising concerns about its ability to provide an accurate and comprehensive picture of compliance.

Overall, there is a lack of robust, large-scale evidence on current levels of adherence to the SFS. Given that standards are legally mandated and intended to protect children's nutritional health, the absence of a clear and systematic monitoring mechanism raises an important question: How effectively are these standards implemented and adhered to in practice?

In England, schools operate under a range of catering arrangements, including local authority provisions, external commercial providers, and in-house kitchens (Fig. 1). These models differ in organisational structure, procurement practices, menu standardisation, and levels of oversight, which may influence how consistently the SFS is implemented in practice. For example, large external providers often use centrally planned menus and established supply chains, whereas in-house provisions may involve greater flexibility but fewer formal monitoring processes (16). However, there is limited evidence on whether compliance with the SFS varies across these arrangements, leaving uncertainty about how consistently the standards are implemented across the school system.

Figure 1 - **Schematic of different catering models**

Figure 1. *Schematic of school catering models in England, showing in-house, external, and local authority provisions.*

Menu-based analysis offers a potential approach for large-scale monitoring of school food provisions. School menus are routinely published on school websites and represent the foods that schools formally

intend to provide, making them a practical and accessible source of data for assessing provisions across multiple settings (11, 17–19). Compared with observational methods, menu analysis is less resource intensive and more feasible to apply at scale, supporting systematic evaluation across a larger number of schools (17).

However, important limitations remain. The SFS is written at a policy level rather than as operational menu criteria, meaning that menus must be interpreted through a clear and systematic framework to translate the standards into measurable indicators.

While structured menu-based approaches have been applied internationally in countries such as the USA, Brazil, Australia, and Spain (17–19), their use in England remains limited. The existing UK-based methods, such as the School Menu Healthiness Assessment Tool (SMHAT) applied in Wales, have focused on overall menu health rather than direct assessment of compliance with the SFS (11). As a result, there is still limited evidence on how menu-based approaches can be used to systematically evaluate compliance with the SFS in English primary schools, highlighting a gap in scalable and standardised methods for monitoring implementation.

Therefore, this study aimed to assess the level of compliance of primary school menus with the SFS in England across three regions representing different catering models. Specifically, the study examined overall compliance, as well as compliance across different food group categories within standards.

Methods

Study Design and Data Collection

A cross-sectional study design was used to analyse lunchtime menus published by state-funded primary schools across three regions in England from 1 September 2025 to 1 December 2025. A cross-sectional approach allows assessment of compliance with the SFS at a single timepoint and enables comparison across different socioeconomic contexts, geographical areas and catering provision models. All the data were derived from publicly available school menu documents. No direct observation, procurement data or pupil-level dietary data were collected.

A purposive region-based sampling strategy was used to ensure representation across differing socioeconomic contexts. Three regions were selected to reflect contrasting levels of deprivation as measured by the Index of Multiple Deprivation (IMD). Within each selected region, all state-funded primary schools were eligible for inclusion if the school food menu was available online. Schools were included if they were state-funded primary schools within the selected regions and had a publicly accessible online menu at the time of data collection; schools were excluded if no menu was available online. Across the three regions, a total of 114 schools were identified. Of these, 105 schools met the inclusion criteria and were included in the analysis. Nine schools were excluded because a menu was not available online. In Region 1, all 40 schools identified were included. In Region 2, 31 of the 32 schools

were included, with one school excluded. In Region 3, 35 of 43 schools were included, and eight schools were excluded because the school menu was not available online.

The socioeconomic and demographic characteristics of the three regions are presented in Table 1. Indicators included the IMD ranking, child poverty rates, ethnic diversity and school meal provision models. IMD scores are presented as relative rankings, where lower scores indicate higher levels of deprivation.

Table 1
shows characteristics of the three study regions including urban classification, ethnic diversity, deprivation, child poverty rates and school catering types.

<i>Schools included in the study/ Schools in region</i>	<i>Region 1</i>	<i>Region 2</i>	<i>Region 3</i>
	<i>40 out of 40</i>	<i>30 out of 31</i>	<i>35 out of 43</i>
<i>Classification (20)</i>	<i>Urban: Majority nearer to a major town or city</i>	<i>Urban: Majority nearer to a major town or city</i>	<i>Urban: Majority nearer to a major town or city</i>
<i>Cultural and Ethnic Diversity (ONS,2022) (21)</i>	<i>29.4% ethnicity other than white</i>	<i>64% ethnicity other than white</i>	<i>20.2% ethnicity other than white</i>
<i>Index of Multiple Deprivation (IMD) Score (22)</i>	<i>1</i>	<i>5</i>	<i>10</i>
<i>Child Poverty Rates (23)</i>	<i>45.4%</i>	<i>36.4%</i>	<i>17.6%</i>
<i>Catering Types (Type – number of school)</i>	<i>External (4), In House (4), Local Authority (32)</i>	<i>External (17), In House (14)</i>	<i>External (28), In House (6)</i>

Schools were included if they were state-funded primary schools located within one of the selected regions and published a lunchtime menu covering at least three consecutive weeks. Menus had to be publicly accessible through school websites. Special schools were excluded because their food provision frequently follows specialised dietary requirements that do not directly correspond to the mainstream SFS framework.

Menus were obtained from publicly available school websites and downloaded in their original format, including PDF documents, images, webpages and digital menu charts. Menus were archived verbatim to preserve the original wording used for coding.

When multiple versions of menus were available, the most recent menu published at the time of data collection was selected. If menu information was missing or unclear, schools were contacted directly to request a complete copy. Because the study relied exclusively on published menu descriptions, no additional information on food procurement, preparation practices or pupil consumption was collected.

Menu interpretation framework and compliance assessment

School menus frequently contain broad or ambiguous food descriptions, such as “pasta bake” or “fruit dessert”, which require consistent interpretation during analysis. To ensure standardised classification, a structured menu interpretation framework was developed.

The framework translates all statutory SFS requirements into operational definitions suitable for menu-based analysis. The development of the framework was informed by the SFS Regulations (9), the SFS Practical Guide (24) and methodological guidance from the FUEL study (3). The framework specifies which foods contribute to each requirement, which items are excluded, how composite dishes are classified, and which standards cannot be assessed via menu data alone. The full interpretation framework is provided in Supplementary Appendix 1.

All menus were coded by the first author (MK) via the interpretation framework. Prior to full coding, two independent researchers (MK and IP) conducted a calibration exercise to standardise the interpretation of ambiguous menu items and ensure the consistent application of classification rules. A subset of menus was independently reviewed by the second researcher, and any discrepancies were discussed and resolved through consensus.

Compliance with the statutory SFS was assessed via the binary scoring approach shown in Supplementary Appendix 2. Each standard was coded as compliant (score = 1) when the required food provision was present or a restricted item was absent, on the basis of explicit menu wording. A score of 0 was assigned when a standard was clearly not met. When insufficient information was provided to determine compliance, standards were coded as noncompliant in line with a conservative interpretation approach.

Compliance was calculated at the school level as the percentage of assessable standards met across the menu cycle. Domain-specific compliance was also calculated for key food groups, including starchy foods, fruit and vegetables, dairy products, protein foods and restricted foods.

The data were managed via Microsoft Excel. Separate regional worksheets were created with one row per school and columns representing each assessable SFS variable requirement. Automated formulas were used to calculate compliance percentages, which were then categorised into four groups: fully compliant (75–100%), mostly compliant (50–74.99%), partially compliant (25–49.99%), and not compliant (0–24.99%) (25). After regional coding was completed, all the datasets were combined into a single master dataset for analysis.

The primary outcome was the percentage of assessable SFS scores met by each school. The secondary outcomes included compliance within specific food domains, including starchy foods, fruit and vegetables, dairy foods, protein foods and standards restricting foods high in fat, sugar and salt.

Data analysis

Descriptive statistics were used to summarise overall compliance with the SFS and to explore variation across regions. Compliance scores were calculated at the school level and expressed as proportions bounded between 0 and 1 (equivalent to 0%–100% compliance), resulting in censoring at both the lower and upper limits. These scores were aggregated to examine patterns by deprivation level, catering provision model, and regional characteristics.

To investigate associations between school characteristics and compliance, Tobit regression was used to appropriately model the censored distribution of the outcome variable, as the compliance scores were bounded between 0 and 1, resulting in clustering at the upper and lower limits. All analyses were conducted via Stata (26).

As the study aimed to include all eligible schools within the selected regions, the sample size was determined by availability rather than a priori calculation. This approach is consistent with descriptive and exploratory analyses designed to identify patterns in real-world data.

Ethics

Ethical approval was not required for this study because all the data were obtained from publicly available school menu documents, and no human participants or identifiable personal data were involved.

Results

School Sample:

Menus from 105 schools were included across three regions: Region 1 (n = 40), Region 2 (n = 30), and Region 3 (n = 35). Twenty-four (Region 1 = 4, Region 2 = 14, Region 3 = 6) schools used in-house catering, 49 (Region 1 = 4, Region 2 = 17, Region 3 = 28) used external catering providers, and 32 (Region 1) were catered by the local authority.

Objective 1 - Overall SFS compliance

As shown in Table 2, the overall mean level of lunchtime compliance with the SFS across all schools was 66.12% (SD 8.32%). The mean compliance rate was 66.72% in Region 1, 67.59% in Region 2, and 64.07% in Region 3. The median compliance rate was identical across all regions at 68%.

Table 2

Summary of overall SFS compliance by study region and total sample. The table presents descriptive statistics for overall lunchtime compliance across Regions 1 to 3 and the combined sample. The statistics included the mean percentage compliance, standard deviation, median, minimum and maximum values, range, and interquartile range. Compliance categories are defined as fully compliant at 75% or above, mostly compliant at greater than 50% and up to 75%, and partially compliant at greater than 25% and up to 50%. The percentages are rounded to the nearest whole number.

Summary of overall compliance	Study Region			Total
	1	2	3	
Mean	67%	68%	64%	67%
Standard deviation	4%	11%	6%	7%
Median	68%	68%	68%	68%
Maximum	73%	79%	70%	79%
Minimum	50%	35%	53%	35%
Range (%)	23%	44%	17%	44%
Interquartile Range	0%	15%	9%	8%
Number of Schools Fully Compliant ($\geq 75\%$)	0	9	0	9
Number of Schools Mostly Compliant ($> 50\%$ and $\leq 75\%$)	40	17	35	92
Number of Schools Partially Compliant ($\leq 50\%$ and $> 25\%$)	0	1	0	1

Interquartile ranges differed between regions. Region 1 had an IQR of 0%, Region 2 had an IQR of 15%, and Region 3 had an IQR of 9%.

The schools were categorised into four compliance groups on the basis of overall SFS compliance. Fully compliant schools achieved scores of 75% or above, mostly compliant schools scored from 50% to less than 75%, partially compliant schools scored greater than 25% to 50%, and noncompliant schools scored 25% or below.

Overall, 96 schools (91%) were classified as mostly compliant, 9 schools (8%) as fully compliant, and 1 school (1%) as partially compliant. No schools were classified as not compliant.

Regionally, all schools in Region 1 (100%) and Region 3 (100%) were classified as mostly compliant. In Region 2, 21 schools (68%) were mostly compliant, 9 schools (29%) were fully compliant, and 1 school (3%) was partially compliant.

Objective 2 - Compliance According to Food Groups

Figures 2a and 2b present compliance with provision-based and restrictive standards across food groups. Provision-based standards include requirements for daily or weekly inclusion of specified food groups and food items. Restrictive standards include limits on specific food types; preparation methods; and products high in fat, sugar or salt.

Figure 2a – **Provision-based standards**

Figure 2a. *Percentage of schools meeting provision-based SFS across food groups (all regions combined).*

Figure 2b – **Restrictive-based standards**

Figure 2b. *Percentage of schools meeting the restrictive SFS across food groups (all regions combined).*

Provision-based standards (Fig. 2a) demonstrated higher compliance than did restrictive standards across food groups (Fig. 2b). Standards requiring the routine inclusion of core food groups were met by most schools. For example, the daily provision of starchy foods was achieved by 96% of the schools overall, and 98% of the schools provided three or more different starchy foods each week. The daily provision of vegetables or salad and dairy foods was met by 100% of the schools, whereas the daily nondairy protein provision was 98%. In contrast, standards requiring specific product types within provision-based categories, such as whole-grain starchy foods (15% overall) and the availability of lower fat or lactose reduced milk (29% overall), presented lower compliance.

Restrictive standards demonstrated greater variability and, in several cases, lower overall compliance. The goal of limiting meat or poultry products to no more than once per week was met by 20% of the schools overall. Compliance with restrictions on deep-fried, batter-coated or breadcrumb-coated foods was 34% overall, with substantial regional variation. Similarly, compliance with no confectionery, chocolate or chocolate-coated products was 34% overall, and only 43% of the schools met the standard related to desserts, cakes and biscuits at lunchtime. Some restrictive standards, including limits on pastry-containing foods (87%), restrictions on snacks (87%), and savoury crackers or breadsticks served with appropriate accompaniment (98%), resulted in increased compliance.

Overall, standards requiring the inclusion of core food groups were more consistently met than those requiring the restriction of specific products or preparation methods.

Overall compliance by food group is presented in Fig. 3.

Figure 3

Figure 3. *Average percentage compliance with the SFS across food categories in Regions 1 to 3 and the total sample.*

Compliance was highest for fruits and vegetables, followed by nondairy protein and dairy protein. Compliance with starchy foods was lower, and the lowest overall compliance was observed for HFSS.

For starchy foods, compliance was 52% in Region 1, 77% in Region 2, and 87% in Region 3.

Fruit and vegetable compliance was 96% in Region 1, 76% in Region 2, and 89% in Region 3.

Compliance with nondairy protein standards was 81% in Region 1, 69% in Region 2, and 62% in Region 3.

For dairy protein, compliance was 91% in Region 1, 55% in Region 2, and 50% in Region 3.

Compliance with the HFSS standards was 49% in Region 1, 82% in Region 2, and 49% in Region 3.

Objective 3 - Compliance with individual SFS standards

Figures 4a to 4e present compliance with individual SFS standards across food groups for all schools.

Across food groups, Regions 1 and 3 demonstrated high compliance with core daily provision standards. Region 2 showed greater variability, particularly within standards related to foods high in fat, sugar, and salt. Standards requiring specific product types or restrictive limits were less frequently met across all regions, notably those related to wholegrain provision, oily fish, meat product restrictions, and HFSS foods.

Starchy foods (Fig. 4a)

Figure 4a Percent compliance with starchy SFS in Regions 1–3 and the total sample.

Compliance with starchy food standards was high across all regions for daily provision and weekly variety. The requirements for one or more portions of starchy food each day and for three or more different starchy foods each week were met by most schools in all regions.

In contrast, compliance with whole-grain provision was low in all regions, although Region 2 showed slightly higher compliance than Regions 1 and 3 did. The availability of bread with no added fat or oil showed marked regional variation, with very low compliance in Region 1 and higher compliance in Region 3.

Fruit and vegetables (Fig. 4b)

Figure 4b. Percentage compliance with the Fruit and Vegetable SFS in Regions 1–3 and the total sample.

Standards related to fruits and vegetables were met by most schools across regions. The daily provision of vegetables or salad and fruit was almost universal. For fruit-based desserts and weekly varieties of fruits and vegetables, region 3 consistently demonstrated lower compliance than the other regions did.

Nondairy protein (Fig. 4c)

Figure 4c Average percentage compliance with nondairy protein SFS in Regions 1–3 and the total sample.

The daily provision of nondairy protein and serving of meat or poultry on three or more days each week showed high compliance across regions. However, substantial regional variation was observed for oily fish provision, with high compliance in Region 1 and lower compliance in Regions 2 and 3. Limiting meat or poultry products to no more than once per week resulted in low compliance in all regions. The provision of suitable nondairy protein options for vegetarians remained relatively high but declined slightly from Region 1 to Region 3.

Dairy protein (Fig. 4d)

Figure 4d Average percentage compliance with dairy protein SFS in Regions 1–3 and the total sample.

The daily provision of dairy foods was achieved by all schools across regions. In contrast, the availability of lower fat or lactose reduced milk was less consistent and varied between regions, with higher compliance in Region 1 than in Regions 2 and 3.

HFSS foods (Fig. 4e)

Figure 4e Average percentage compliance with the HFSS SFS in Regions 1–3 and the total sample.

Compliance with HFSS standards showed greater variability than did compliance with other food groups. High compliance was observed for standards permitting savory crackers or breadsticks under specified conditions. Compliance with limits on pastry-containing foods was highest in Region 1 and lower in Region 3. Restrictions on deep-fried foods and confectionery showed low compliance in Regions 1 and 3, whereas Region 2 demonstrated comparatively higher adherence to these restriction-based standards.

Overall, across regions and food groups, provision-based standards were more frequently met than standards requiring restrictions or specifications of product types.

Objective 4 - Associations between SFS compliance and socioeconomic indicators

Tobit regression analysis (Table 3) indicated that SFS compliance was not significantly associated with the proportion of pupils receiving free school meals (FSM) at the 5% level ($\beta = 0.020$, $p = 0.067$), although a positive association was observed at the 10% significance level. Two schools were excluded from the regression analysis because of missing covariate data ($n = 103$).

A statistically significant negative association was identified between SFS compliance and the IMD ($\beta = -0.013$, $p = 0.007$), indicating lower compliance among schools in more deprived areas. In contrast, a positive association was observed between SFS compliance and IDACI scores ($\beta = 0.009$, $p = 0.007$).

Table 3
For the Tobit regression analysis of factors associated with SFS compliance (n = 103), 2 schools were excluded from the analysis because the data were missing.

Dependent variable	Compliance with SFS	Sig.
Region (comp. to 1)		
Region 2	0.029	
	0.027	
Region 3	0.009	
	0.029	
Catering type (comp. to in house)		
Local authority	0.030	
	0.027	
External	0.029	*
	0.017	
Prop. of pupils receiving FSM	0.020	
	0.067	
IMD	-0.013	*
	0.007	
IDACI	0.009	
	0.007	
N	103	
*p < 0.10		

Figure 5 illustrates the marginal effects of catering type across regions. The positive association for external food consumption was more evident in Regions 2 and 3, whereas estimates for Region 1 presented greater uncertainty, with confidence intervals crossing zero.

Figure 5

Figure 5. Predicted marginal effects from Tobit regression models showing the associations between the type of food provision (local authority or external, compared with in-house) and SFS compliance across regions. Points represent estimated effects, and error bars indicate 90% confidence intervals.

Figure 6 illustrates the marginal effects of the IMD on SFS compliance across regions. The negative association between IMD and compliance was most pronounced in Region 2, whereas the effects in Regions 1 and 3 were close to zero and not statistically significant, as indicated by confidence intervals crossing zero.

Figure 6

Figure 6. *Predicted marginal effects from Tobit regression models showing the association between IMD and SFS compliance across regions. Points represent estimated effects, and error bars indicate 90% confidence intervals.*

Discussion

Overall compliance with the SFS

This study revealed that the mean compliance with the SFS across the three regions was 66%, indicating moderate but incomplete adherence to the statutory requirements. On average, schools met between 11 and 16 of the 22 standards assessed in this study. Although many schools appear to implement aspects of the standards from a menu-based perspective, full compliance across all standards was not achieved. Previous studies have reported limited awareness and inconsistent enforcement of the SFS in practice (3, 11, 15). The moderate level of menu-based compliance observed in the present study suggests that full adherence has not yet been achieved in many schools and highlights potential gaps in how the standards are interpreted and implemented.

To better understand where compliance was strongest and weakest, it is useful to examine patterns across the different food groups included within the standards.

Variation in compliance across food groups

Variation in compliance was observed across different food groups. The highest levels of compliance were found for fruit and vegetable standards, whereas the lowest compliance was observed for standards related to HFSS. This pattern is consistent with findings reported by (3). One explanation for lower compliance with HFSS standards is the restrictive nature of these requirements. Unlike provision-based standards, which require schools to include specific food groups, HFSS standards restrict the frequency of certain foods. Limiting commonly used menu items may create practical challenges for menu planning and food procurement within school catering settings. However, HFSSs are widely consumed within schools and are highly familiar with and acceptable to children (27). As a result, these items may already be embedded within established menu cycles and food procurement systems.

The second least compliant food group was dairy and protein foods.

Pallan et al. (2024) reported that dairy and protein foods presented the highest levels of compliance, whereas in the present study, they represented the second least compliant category (3). This lower

compliance was due to the frequent absence of low-fat milk at lunch. However, this standard is intended to be assessed across the whole school day rather than at lunch alone (9). Differences in compliance may reflect methodological variation, as this study assessed only lunchtime provisions, whereas some standards apply across the whole school day.

Compliance with individual standards

Examining compliance at the level of individual standards provides further insight into where adherence to the SFS was strongest and weakest. High levels of compliance were observed for several provision-based standards, particularly those requiring the daily availability of fruit, vegetables, starchy foods, and protein sources. For example, standards requiring starchy foods to be provided daily, vegetables or salad to be available each day, and meat or poultry to be served on three or more days per week showed consistently high adherence. These standards primarily require the inclusion of food groups and may therefore be easier to implement within existing menu structures, as most school meals already contain starch, protein, and vegetable components and therefore require only minor adjustments to meet these requirements. Provision-based standards can also be met flexibly by offering a range of suitable items, allowing caterers to add compliant foods without necessarily removing existing menu items.

The lower compliance with restrictive standards appears to reflect the challenges associated with limiting commonly used foods. Unlike provision-based standards, which can be met by adding items to menus, restrictive standards require the removal or reduction of foods that are already embedded within menu cycles and are often popular with pupils.

In practice, school meals operate within constrained budgets and large-scale food service environments, where HFSS foods are often low cost, widely available, and easy to prepare at scale (27, 28). Procurement arrangements with large suppliers may further limit the availability of suitable alternatives, whereas pupil preferences may incentivise the retention of more popular items to maintain meal uptake (16).

Consistent with these challenges, lower compliance was observed for several HFSS-related standards, including limits on confectionery, chocolate-containing desserts, and deep-fried or coated foods. These findings are broadly consistent with the FUEL study (3). However, the present study also revealed lower compliance with standards related to whole-grain starchy foods, lower-fat milk availability, and vegetarian nondairy protein provision, which is consistent with previous findings (11).

Another explanation relates to ambiguity in the wording of some standards and the way detailed definitions are presented within accompanying guidance documents. For example, standards related to foods such as bread and oily fish rely on definitions that are explained more fully in the accompanying “Practical Guide” (29). This separation may create uncertainty regarding how certain foods should be interpreted when planning school menus. For example, the SFS guidance (30) includes items such as buns, bun loaves, and chapatis within the category of bread, which differs from the more limited definition of bread commonly used in England (31).

In addition to ambiguity within the standards themselves, classification challenges may arise when interpreting menu descriptions. Many common school menu items, such as chicken nuggets, goujons, fish fingers, and coated vegetarian products, are preprepared foods that are already breadcrumb-coated or batter-coated during the manufacturing process (29). Menu descriptions often lack detail on cooking methods and preparation, making accurate classification of foods within restricted HFSS categories difficult.

For both whole-grain starchy foods and vegetarian nondairy protein standards, this may partly reflect limitations in menu descriptions. For example, where menus did not specify whether bread was white, wholegrain, or 50/50, it was assumed to be a standard option rather than wholegrain. Similarly, when a vegetarian item was listed but its ingredients were not specified, it was assumed not to include a vegetarian nondairy protein source. This problem has also been reported in previous studies (11). However, lower compliance may also reflect practical barriers, as wholegrain options can be more expensive and may be less acceptable to students (16, 28). When menu details were unclear, assumptions were required (e.g., bread type or vegetarian ingredients), which may have influenced classification and compliance estimates (11).

These findings highlight a limitation in the current evidence base, as the reasons for lower compliance with restrictive standards remain insufficiently understood.

Catering provision

There was variation in food provision across the sample. The statistical analysis indicated that external food provision was associated with higher SFS compliance than in-house provision at the 10% significance level; however, this association was not statistically significant at the conventional 5% level, which may reflect the small sample size. While this may suggest that external providers are better equipped to meet SFS requirements, the evidence remains inconclusive. A recent scoping review revealed no strong evidence that any one catering model is consistently more effective than another (16); therefore, this finding should be interpreted with caution.

It is not possible to determine from these findings whether differences in compliance are attributable to the catering model itself or to underlying factors such as resource availability, procurement systems, and levels of standardisation. External providers may benefit from centralised structures and more uniform processes, whereas in-house provisions may allow greater flexibility but introduce variability in implementation (16). However, these interpretations remain speculative, and the current analysis does not allow causal inference. As such, one catering model may be inherently more effective than another.

Taken together, these findings suggest that while food provision may be associated with differences in compliance, it is unlikely to be the sole determining factor. Instead, compliance may be shaped by a combination of organisational, contextual, and structural influences, highlighting the need for further research to better understand how different catering models support the implementation of the SFS.

Socioeconomic influences

The relationship between deprivation and SFS compliance is not consistent across measures, indicating that socioeconomic influences on provisions are neither uniform nor directly deterministic. Area-level deprivation, as measured by the IMD, was negatively associated with compliance, but this relationship reached statistical significance only in Region 2. Rather than supporting a generalisable deprivation gradient, this pattern suggests that the influence of deprivation is contingent on local structural conditions. This regional variation likely reflects differences in catering structure and governance. Schools in Region 1 were predominantly managed under a single local authority, with standardised menus producing largely uniform compliance. Similarly, schools in Region 3 were primarily served by external food providers operating under a single contractor, again limiting variation in provision. In contrast, Region 2 included a more diverse mix of in-house and externally catered schools, introducing greater variability in menu design and implementation. This heterogeneity provides a plausible explanation for why associations between deprivation and compliance emerged only in Region 2, where variation in catering models and local practices creates conditions under which structural constraints are more likely to manifest. The absence of significant associations in both low- and high-deprivation regions further undermines the assumption of a linear relationship, pointing instead to threshold or context-dependent effects. Taken together, these findings call into question the prevailing tendency in the literature (11, 16, 32, 33) to treat deprivation as a consistent and uniform constraint on school food provision.

In contrast, child-level deprivation, measured by the IDACI, showed a positive but nonsignificant association with compliance. Although not statistically robust, the direction of this association diverges from both the IMD and the wider literature, where deprivation measures typically align, particularly in relation to childhood overweight and obesity (34). This divergence suggests that deprivation does not operate in the same way in the context of policy compliance as it does in health outcomes. While the IMD captures broader environmental and structural constraints (35), the IDACI may instead reflect populations that are more likely to be identified and targeted through support mechanisms. This complicates the assumption that greater deprivation necessarily leads to poorer provision and instead points to the possibility that targeted policy attention may partially offset structural disadvantage in some contexts.

FSM eligibility is a limited proxy for disadvantage and may not adequately capture the broader socioeconomic factors influencing school food provision (36). FSM captures only a narrow dimension of disadvantage and fails to account for wider structural and contextual influences, which likely explains its limited explanatory power in this analysis (36). FSM data were unavailable for two schools, resulting in their exclusion from the regression analysis and potentially reducing their statistical power.

Taken together, these findings indicate that deprivation does not function as a single, coherent determinant of SFS compliance. Instead, different measures capture distinct and sometimes divergent dimensions of disadvantage, which may exert indirect or opposing influences on provisions. Compliance

therefore appears to be shaped less by deprivation itself than by how deprivation is mediated through structural factors such as resource allocation, local authority capacity, and policy implementation. This shifts the analytical focus away from deprivation as a direct explanatory variable and towards the systems and mechanisms through which its effects are realised.

Finally, while existing evidence links SFS provision to dietary intake and health outcomes, menu-based analyses capture intended provision rather than actual consumption and therefore provide only a partial account of impact (13). This limits the extent to which compliance can be interpreted as a proxy for effectiveness. The current evidence remains limited in explaining how structural and contextual factors interact with deprivation to influence SFS compliance.

Strengths

A key strength of this study is the use of a structured menu interpretation framework to assess compliance with the SFS. The framework established clear rules for interpreting menu items, ensuring that the same criteria were applied consistently across all schools included in the analysis. This transparent scoring approach reduced subjectivity when menu descriptions were interpreted and improved the reproducibility of the analysis.

Menu analysis has been widely used in school food research and policy evaluation as a practical method for assessing compliance with the SFS (12, 37–39). Compared with more resource-intensive approaches such as in-school observations, plate waste studies, or dietary assessment, menu analysis provides a cost-effective and feasible approach for examining compliance across larger numbers of schools.

Another strength of the study is the inclusion of a large sample of schools across multiple regions. The multiregional sample captures variation in socioeconomic context, school characteristics, and catering provision models, allowing comparison of compliance patterns across different geographic areas. This improves the external validity and generalizability of the findings.

Finally, the use of statistical analysis strengthened the credibility of the results. Nonparametric testing enabled comparisons of compliance levels across regions, whereas correlation analysis examined associations between compliance and socioeconomic indicators.

Limitations

Several important limitations should be considered when interpreting the findings of this study, particularly in relation to measurement validity, scope, and the interpretation of associations.

First, the use of menu analysis as a proxy for SFS compliance introduces inherent limitations in validity. Menus reflect *intended provisions* rather than foods actually prepared, served, or consumed. In practice, deviations from planned menus are common due to supply constraints, staffing, or operational adjustments, meaning that recorded provisions may not accurately represent real-world practice (37). Furthermore, the presence of compliant items on menus does not ensure their selection or consumption

by pupils, and evidence suggests that healthier items, particularly vegetables, are frequently discarded (39). As a result, menu-based compliance is likely to overestimate the extent to which standards translate into meaningful dietary exposure, limiting the ability to infer implications for nutritional intake or health outcomes.

Second, the accuracy of compliance assessment is constrained by the quality and specificity of menu data. Menu descriptions, such as cooking methods, ingredient compositions, or product formulations, are often insufficiently detailed to determine the key characteristics required for classification. This is particularly problematic for HFSS-related standards, where distinctions between compliant and noncompliant items depend on processing or preparation (e.g., deep-frying or coating). Consequently, classification is subject to misclassification bias. Although a structured interpretation framework was applied to standardise decision-making, the necessity of applying assumptions, such as defaulting to nonwholegrain products or excluding unspecified vegetarian protein sources, introduces systematic uncertainty into the estimates. While these assumptions are applied consistently, they may bias results in a conservative direction and limit comparability with studies using alternative classification approaches (11).

Third, the restriction of the analysis to lunchtime provisions represents a substantive limitation in scope. The SFS applies across the whole school day, including breakfast and other food provisions (9), and some standards are explicitly intended to be assessed in this broader context. Focusing solely on lunch may therefore lead to misclassification of compliance, particularly for standards relating to dairy provisions or snack restrictions. This also limits comparability with studies assessing full-day provision and may partially explain the observed discrepancies in compliance patterns across studies (3).

Fourth, menu-based analysis does not capture the broader school food environment, including the availability of competitive foods, informal food provision, or behavioural and environmental influences on food choice. Factors such as pricing strategies, portion sizes, product placement, and peer dynamics may significantly influence dietary behavior but remain unobserved in this approach. This omission limits the ecological validity of the findings and constrains the interpretation of how menu compliance translates into actual food environments experienced by pupils.

Fifth, the cross-sectional design limits causal inference and restricts interpretation of observed associations. While relationships between compliance and factors such as food provision or deprivation were explored, these analyses cannot establish directionality and may be subject to confounding. For example, differences attributed to the catering model may instead reflect unmeasured factors such as funding levels, procurement systems, or organisational capacity. Similarly, the exclusion of two schools due to missing FSM data may have reduced the statistical power and introduced bias, particularly if missing data were not random.

Sixth, the measurement of socioeconomic context presents conceptual and methodological challenges. FSM eligibility, while widely used, captures only a narrow and administratively defined subset of disadvantage and fails to account for broader structural conditions, limiting its explanatory value (36).

Area-level measures such as the IMD and IDACI capture different dimensions of deprivation but may not align with the operational realities of individual schools, introducing potential ecological fallacies. The divergence observed between these indicators in the present study highlights the limitations of treating deprivation as a single, coherent construct and complicates the interpretation of its relationship with compliance.

Seventh, although the study includes multiple regions, the sample is not nationally representative and may be influenced by region-specific organisational structures, such as local authority arrangements or catering contracts. This limits the generalisability of the findings and raises the possibility that the observed patterns reflect local system characteristics rather than broader national trends.

Finally, limitations in the current evidence base constrain interpretation of the findings. In particular, empirical research examining why compliance with restrictive SFS standards tends to be lower than compliance with provision-based standards is limited, and the mechanisms underlying this pattern remain underexplored. This restricts the ability to situate the findings within a well-developed theoretical or empirical framework.

Taken together, these limitations highlight that SFS compliance, as measured through menu analysis, should be interpreted as an indicator of planned provisions rather than a definitive measure of implementation or impact. Future research would benefit from integrating menu analysis with observational methods, consumption data, and qualitative investigations of school food systems to provide a more comprehensive and valid assessment of policy implementation.

Conclusion

Overall, this study revealed that the mean compliance with the SFS across primary school lunch menus in the three study regions was 66%, indicating moderate but incomplete adherence to the statutory requirements. While standards requiring the routine provision of core food groups, such as fruit, vegetables, starchy foods, and protein sources, were well met, lower compliance was consistently observed for restrictive standards related to foods high in fat, salt, and sugar. These findings suggest that standards requiring limitations of commonly used foods may present greater practical challenges for schools and catering providers. The results also demonstrate that menu-based analysis can provide a feasible and scalable approach for assessing compliance with statutory school food policies. Strengthening monitoring systems, clarifying guidance for implementation, and addressing operational barriers within school catering environments may help improve adherence to standards and support healthier school food provisions across England

Abbreviations

- SFS
School Food Standards
- HFSSs

Foods high in fat, sugar, and salt

- **IMD**

Index of Multiple Deprivation

- **IDACI**

Income Deprivation Affecting Children Index

- **FSM**

Free School Meals

- **SD**

Standard deviation

- **IQR**

Interquartile range

- **FUEL**

Food provision, culture and environment in secondary schools

- **SACN**

Scientific Advisory Committee on Nutrition

- **SMHAT**

School Menu Healthiness Assessment Tool

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

All the data generated or analysed during this study are included in this published article.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

MK conceived the study, conducted the analysis, and wrote the manuscript.

IP contributed to reviewing the manuscript and supported the statistical analysis.

ME contributed to reviewing the manuscript and assisted with organising the results.

All the authors read and approved the final manuscript.

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Figures

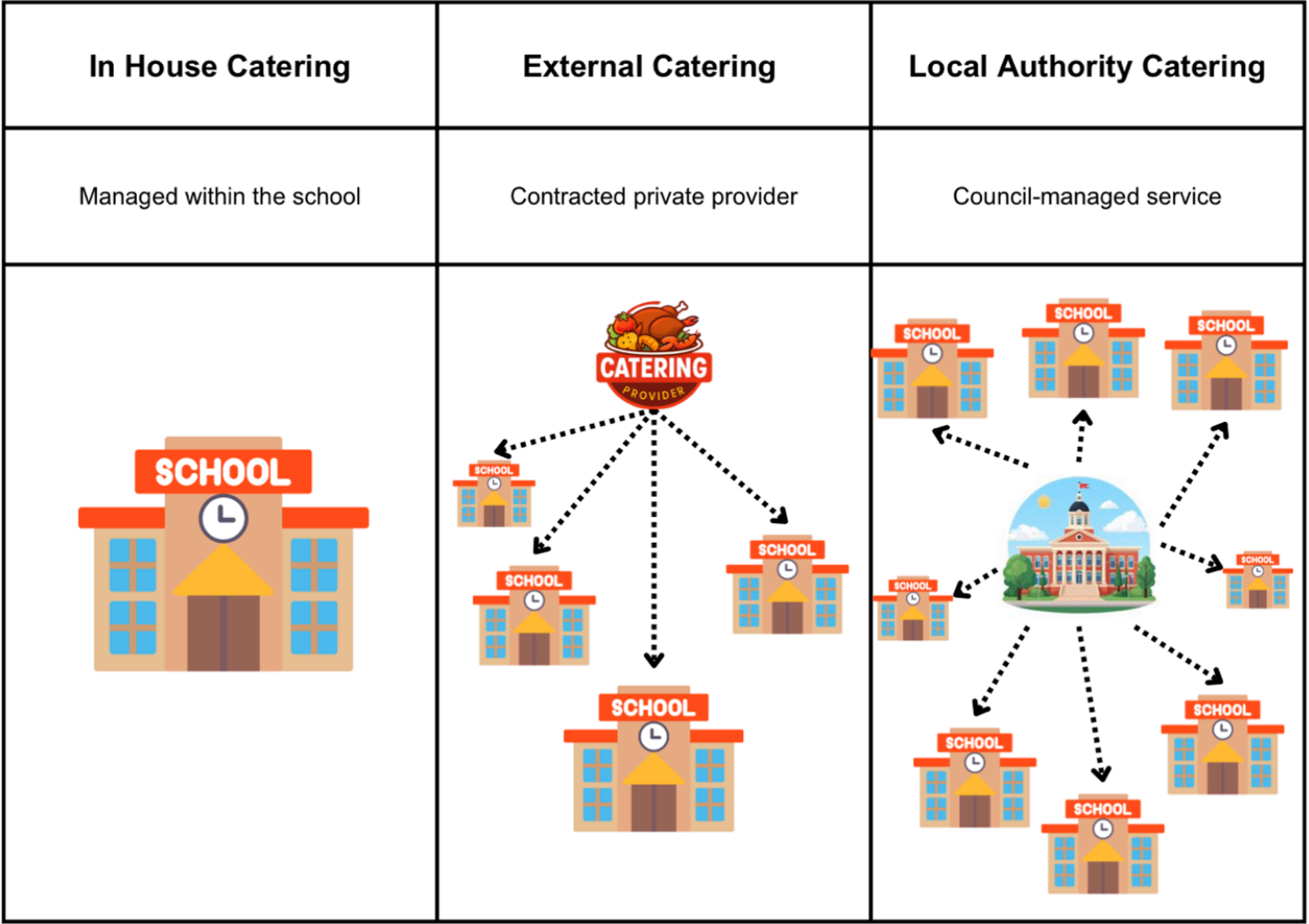


Figure 1

Schematic of different catering models

Figure 1. Schematic of school catering models in England, showing in-house, external, and local authority provisions.

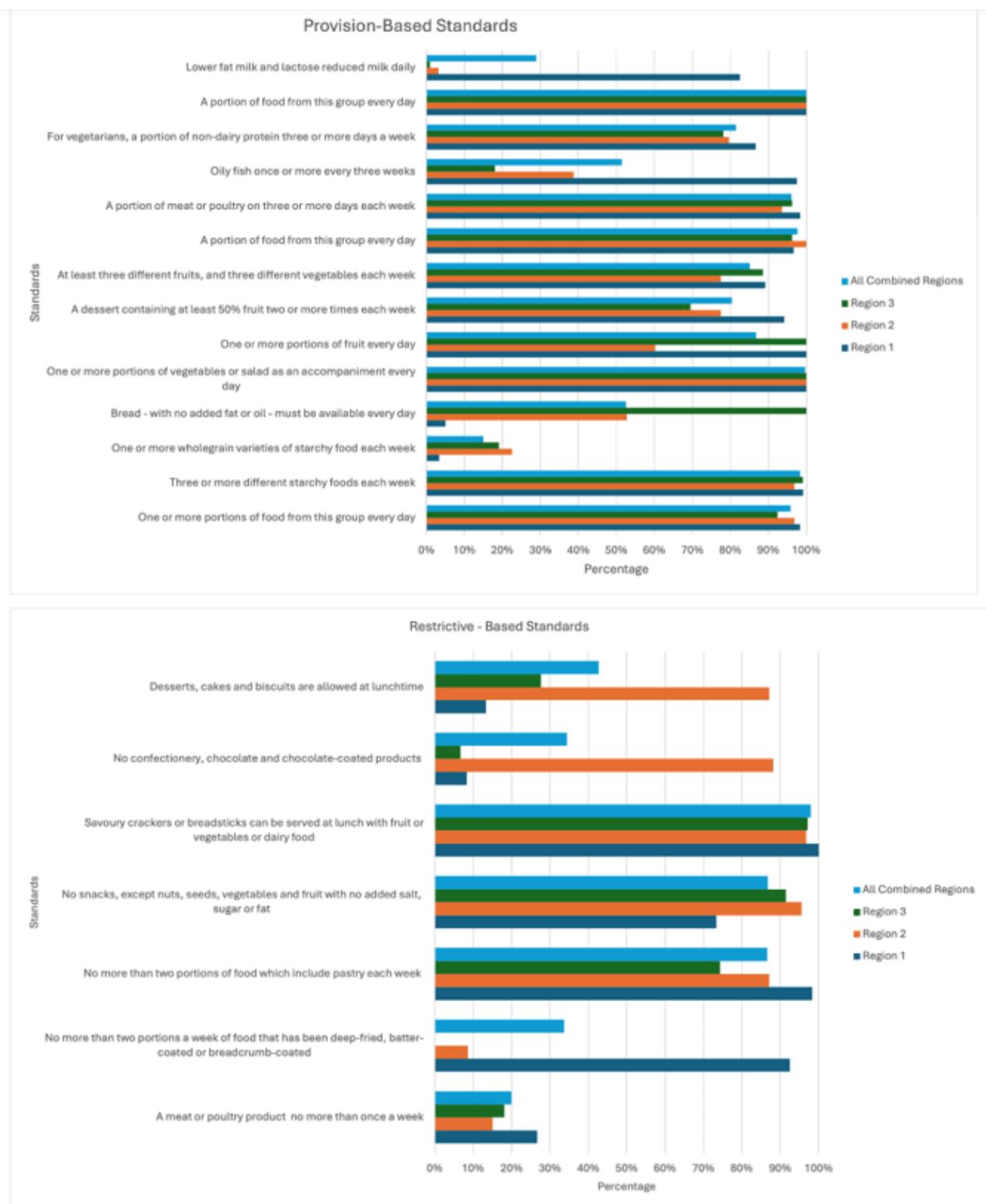


Figure 2

a – Provision-based standards

Figure 2a. Percentage of schools meeting provision-based SFS across food groups (all regions combined).

b – Restrictive-based standards

Figure 2b. Percentage of schools meeting the restrictive SFS across food groups (all regions combined).

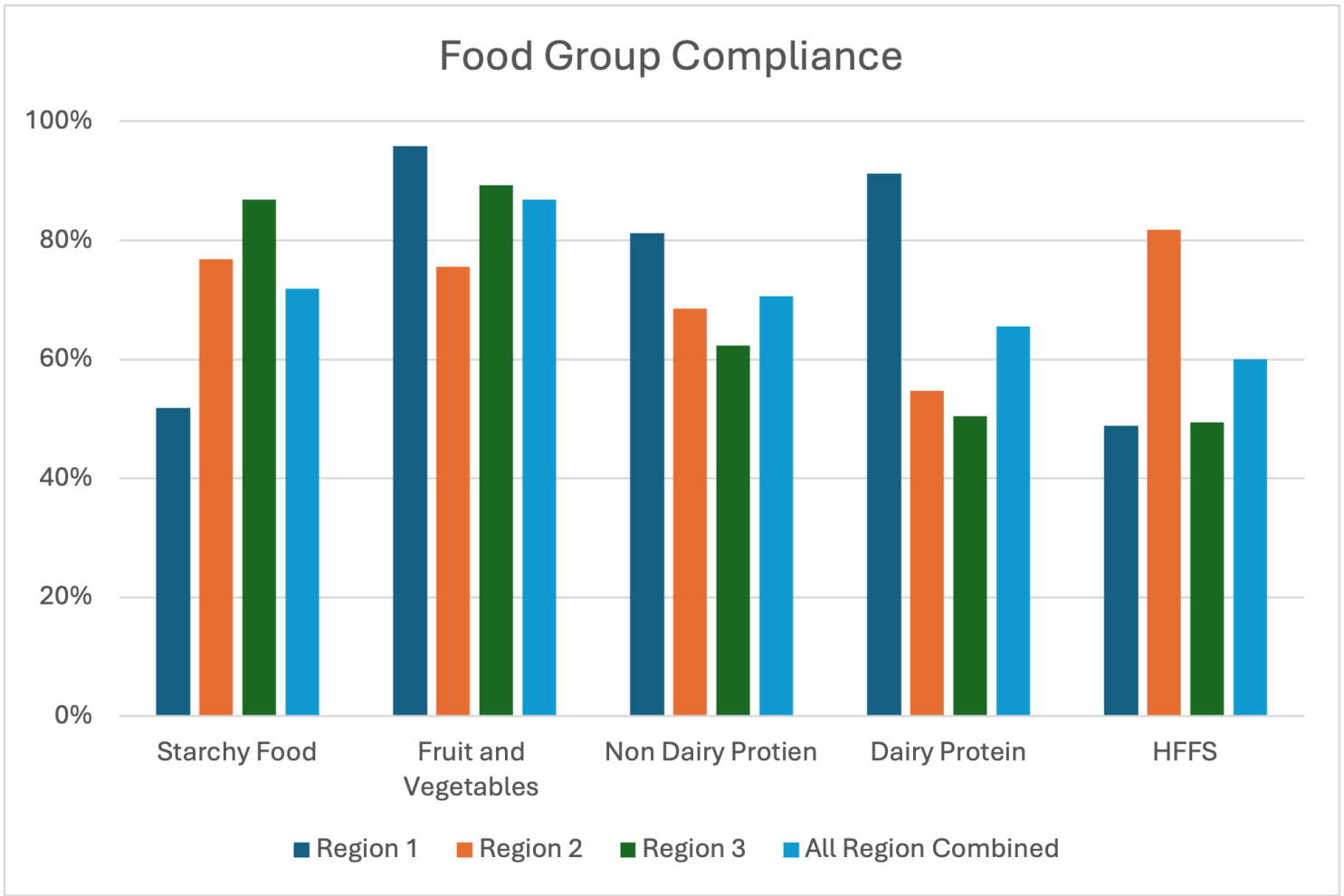


Figure 3

Average percentage compliance with the SFS across food categories in Regions 1 to 3 and the total sample.

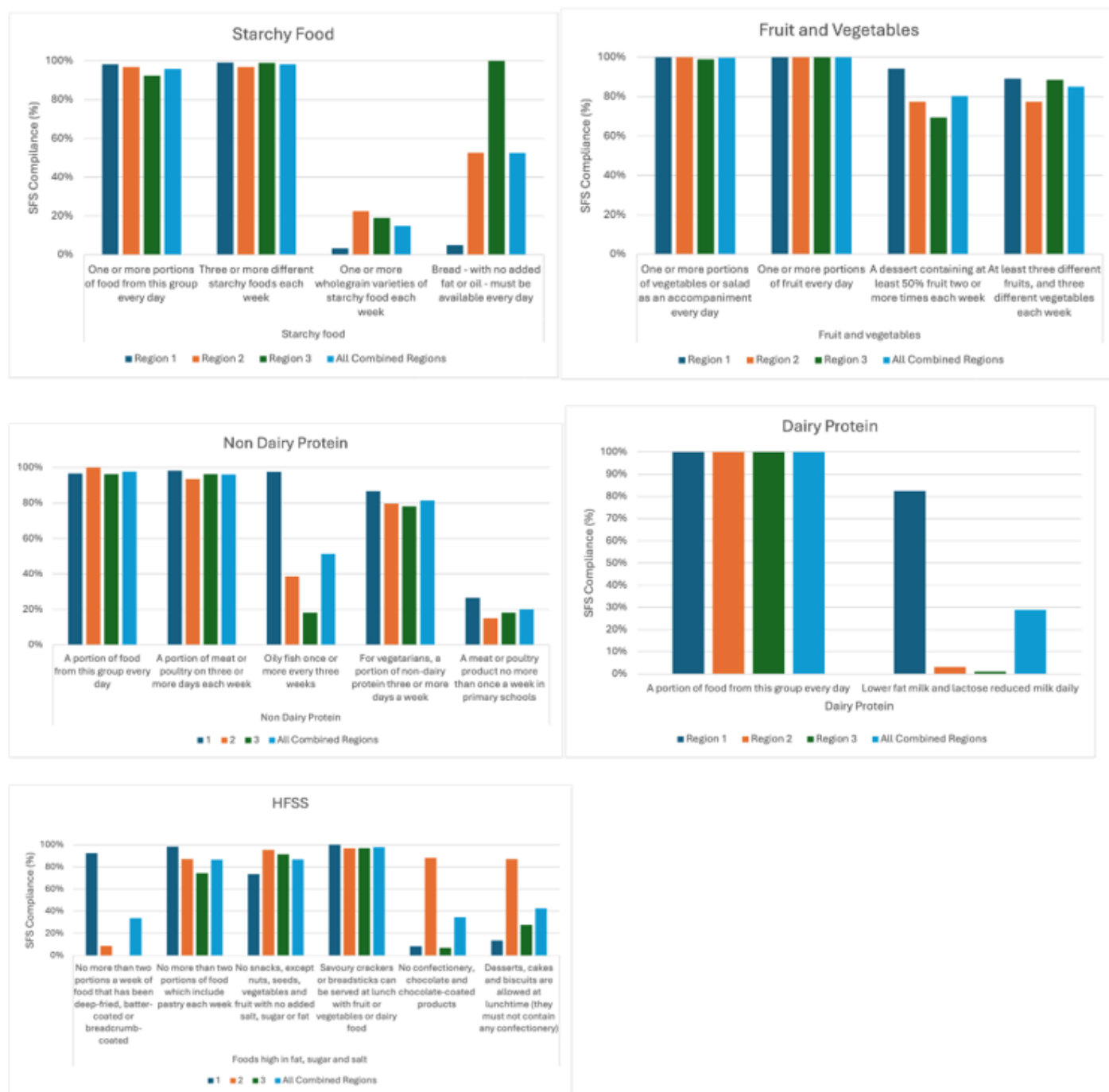


Figure 4

a Percent compliance with starchy SFS in Regions 1–3 and the total sample.

b. Percentage compliance with the Fruit and Vegetable SFS in Regions 1–3 and the total sample.

c Average percentage compliance with nondairy protein SFS in Regions 1–3 and the total sample.

d Average percentage compliance with dairy protein SFS in Regions 1–3 and the total sample.

e Average percentage compliance with the HFSS SFS in Regions 1–3 and the total sample.

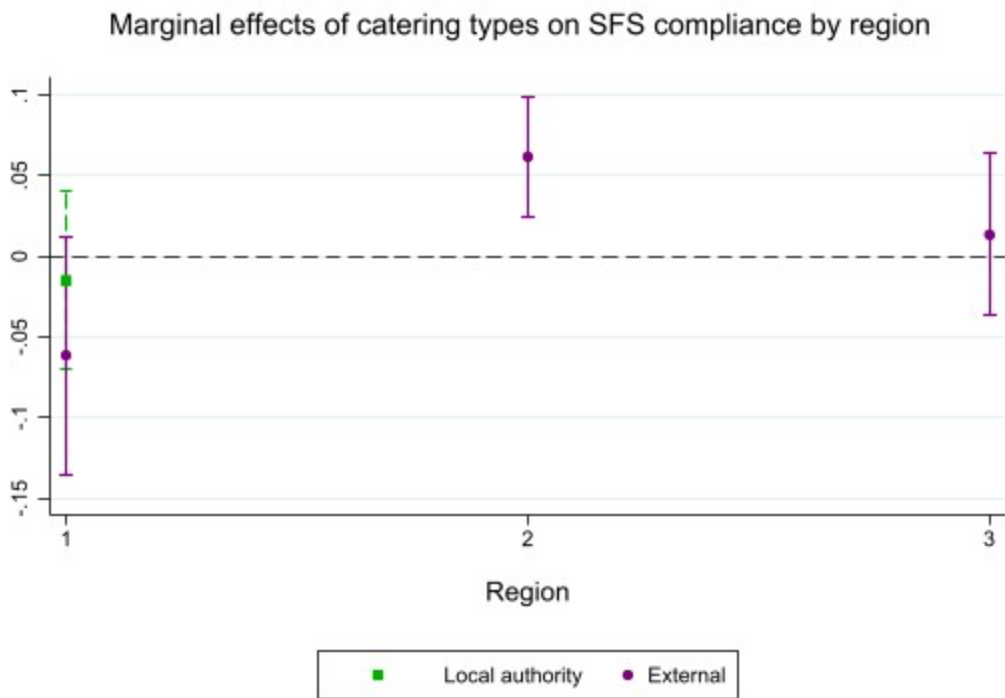


Figure 5

Predicted marginal effects from Tobit regression models showing the associations between the type of food provision (local authority or external, compared with in-house) and SFS compliance across regions. Points represent estimated effects, and error bars indicate 90% confidence intervals.

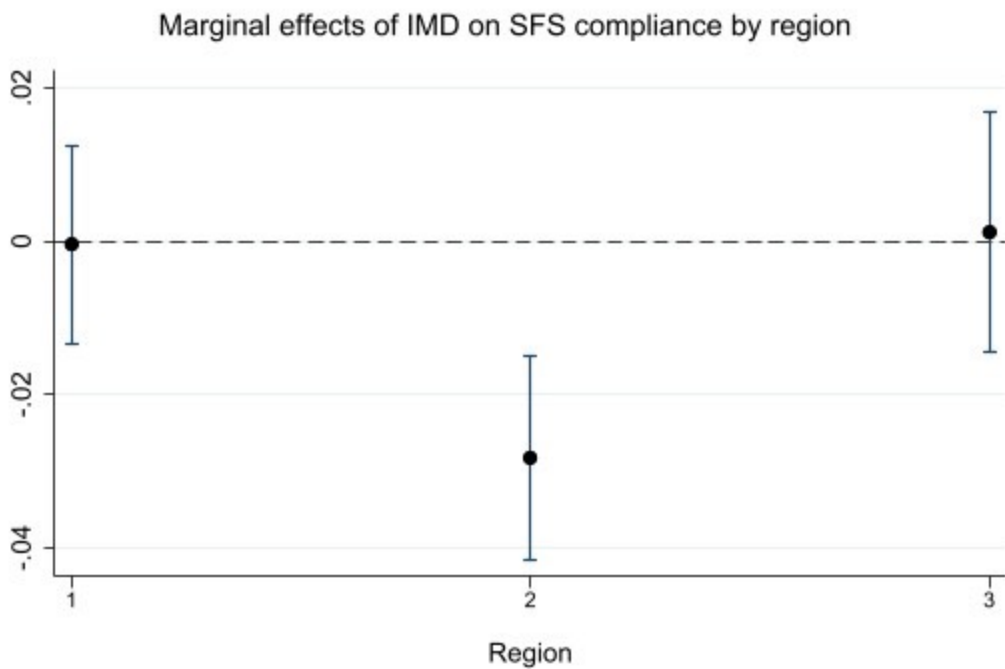


Figure 6

Predicted marginal effects from Tobit regression models showing the association between IMD and SFS compliance across regions. Points represent estimated effects, and error bars indicate 90% confidence intervals.

Supplementary Files

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- [Appendix1.docx](#)
- [Appendix2.docx](#)