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When Canteens Are Absent: Family Food Routines, Adolescents' Autonomy, And School- Day Eating in Rural Poland*

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Abstract

School- day nutrition in rural settings is a service- delivery challenge affecting human capital. Using an anonymised questionnaire from rural Polish primary schools without canteens (N= 266; ages 10– 16), this study quantifies retail substitution under missing infrastructure. A compact indicator set- second breakfast from home, school-shop purchases, exposure to lunch-type meals, meal counts (total/ hot), and demand for hot lunches- was analysed with non-parametric/exact tests (χ^2 with Yates/Fisher; Mann– Whitney; α= 0.05). Pupils maintain eating (≈4.18 meals/day; ≈1.76 hot meals/day), yet provisioning skews to home-packed food and on-site retail (65.4% and 56.8%), while lunch-type meals are rare (26.7%). Age, rather than gender, structures behaviour: older pupils are significantly more likely to use school shops ($p< 0.05$); younger pupils show higher- though not statistically conclusive- demand for hot lunches. This pattern signals a service-delivery gap with implications for nutritional quality and equity. Limitations are acknowledged.

Keywords: adolescent autonomy; school- day eating; rural schools, rural families; Poland,

Introduction

School meal programmes have become a central element of contemporary food policy, valued for their ability to improve children's health, reduce social inequalities, and support educational attainment (European Commision, 2025). In Europe they constitute one of the most substantial welfare investments directed at children, yet provision remains uneven across Member States and, crucially, within countries (European Commision, 2024). Universal models demonstrate that regular, balanced school meals can be embedded in pedagogy and daily school routines (Lundborg et al., 2021). Targeted or fragmented models, in turn, often leave gaps for groups already at risk of poorer health and educational outcomes.

In Poland, national programmes and local initiatives emphasise access to at least one hot meal during the school day (Czarniecka-Skubina et al., 2024). In practice, however, the realisation of this aim depends on local infrastructure, staffing, procurement capacity, and municipal budget cycles (Myszkowska-Ryciak & Harton, 2018).Urban schools are more likely to maintain kitchens and dining spaces (Kowalska, 2007). Many rural schools do not, which effectively shifts responsibility for the midday meal to households or to the limited food environment of school shops (Guio, 2023).Where on-site meal preparation is absent and external catering is either unavailable or cost-prohibitive, pupils rely on packed meals from home or on snack-type purchases in school shops (André et al., 2024;Chaudhary et al., 2020). Observational accounts from Polish schools suggest that when the offer is perceived as unattractive or relatively expensive, pupils substitute structured meals with crisps, sweets,

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and sweetened drinks (Jarossová, 2013). Attempts to restrict the sale of less healthy products, if not paired with viable alternatives, may have unintended effects- for example, shopping outside the school grounds, in nearby grocery shops (Potempa-Jeziorowska et al., 2022).

These behavioural patterns intersect with broader public-health concerns. Overweight and obesity among school-age children remain an important challenge in Poland, with socioeconomic gradients that tend to disadvantage rural populations (Szadowska- Szlachetka et al., 2016;Myszkowska-Ryciak & Harton, 2017). An unbalanced diet, characterized by irregular meal patterns, insufficient fruit and vegetable intake, and excessive consumption of energy- dense processed foods, contributes to these disparities (FAO, 2020;FAO, 2019). Meals consumed during school hours are crucial, as they constitute a significant part of the daily diet for many pupils. Their quality and availability largely depend on the school's catering infrastructure and the regulations in force on its premises (Hamulka et al., 2024). Among children in grades IV–VIII, the transition into early adolescence also increases food autonomy (Jarossová, 2013). Research indicates that older students are more likely to replace nutritious meals with snacks and make impulsive purchases, while younger students are more likely to follow established eating patterns and seek support from adults (Hawkins et al., 2020). These age-related differences are important for nutrition policy, as they reflect different dynamics and directions of change in the eating habits of different groups of pupils(Hawkins et al., 2021). Moreover, a useful way to conceptualise the setting under study is as a constrained school-day nutrition ecosystem composed of three channels: food brought from home, food purchased at or near school (shops, vending, local retailers), and meals provided by the school canteen or catering services (European Commision, 2025). Within this ecosystem, four conditions shape actual intake: availability (what options exist within the school day), accessibility (time, location, and rules that govern access), affordability (prices relative to pupils' pocket money and household resources), and acceptability (taste, familiarity, and social norms) (Hamulka et al., 2024). In low-infrastructure rural schools, the balance of these conditions may tilt towards snack-based substitutions even when knowledge of healthy eating is adequate (Hamulka et al., 2018; (National Nutrion Council, 2017). Educational programmes can improve knowledge and attitudes, but without feasible, acceptable alternatives available during the school day their impact on behaviour remains constrained.

The present study responds to this gap by analysing a baseline questionnaire dataset collected among pupils in grades IV–VIII attending rural primary schools in Poland that do not possess canteen facilities. The study aimed to characterise routine eating behaviours at school, rather than to evaluate a specific intervention. The following areas were examined: breakfast regularity prior to school; the presence of a second breakfast; sources of midday food during the school day (home- brought versus school- shop purchases); the frequency and circumstances of hot-meal consumption; spending patterns and product categories purchased in school shops; and stated demand for hot school lunches if they were to be offered. While the cross-sectional design does not support causal claims, it provides a robust snapshot of behaviours during the school day. The findings are intended to inform choices among a spectrum of realistic options, ranging from low-capital (e.g., defining minimum standards for shop assortments, structuring lunch breaks, ensuring the provision of heated water, and supplying compact warming equipment) to incremental investments (modular kitchenettes, small dining spaces) and partnership- based solutions (pilots with external caterers, community co- financing). In rural settings, where budgets are tight and staffing is limited, the value of such information lies in helping local authorities and school leaders prioritise actions that are both equitable and administratively tractable.

All things considered, these analyses aim to inform feasible interventions in low-infrastructure settings, where the impact of school policy is greatest during the school day, while financial and staffing constraints remain significant.

Literature Review

School meals are not only nutrition policy; they are an essential service-delivery instrument that shapes human capital formation and equity (WILSON, 2017). In peripheral and rural settings, the absence of basic infrastructure (kitchens, dining space) forces households and pupils to substitute structured meals with retail purchases, shifting costs and risks onto families. Framing school nutrition as a service- delivery constraint aligns with the development literature that links program design and state capacity to long-term learning and health returns. School feeding programmes are often framed as much more than a matter of getting food to children; they're a kind of social infrastructure- blending nutrition, education, and welfare (Hamulka et al., 2018). In places where children go to school hungry, having a meal at school is vital(Upreti & Devkota, 2024). In Europe, hunger isn't always the headline issue, but that doesn't mean the absence of healthy food isn't a concern (European Commision, 2025). GCNF(GCNF, 2024b), the WHO(WHO, 2006), and other bodies have long argued that school meals can shape preferences- nudging kids toward fruit, whole grains, dairy, and away from sugary snacks. Still,

what happens in Sweden or Finland (Elo-Foundation, 2020;Finnish National Agency for Education, 2019)may not map neatly onto Poland, where canteen infrastructure is patchy and often determined by the municipal budget, not by nutritional ideals(GCNF, 2024a). What is very important: Poland's situation is complicated. Programs like *A Glass of Milk* or *Fruits and Vegetables at School* are well-intentioned, yet the effects seem modest (European Commision, 2021). They increase children's exposure to healthier foods, but on the other hand, it is less clear whether they change what kids eat at home or even on weekdays (Myszkowska-Ryciak & Harton, 2017;World Food Programme, 2019). That reality likely reflects economic disparities: better-off parents may afford warm meals; others can't. Qualitative studies give a glimpse into everyday school routines (Czarniecka-Skubina et al., 2024). Interviews with principals and canteen staff consistently show that the school food environment shapes choices- whether it is proper meals or just vending machines A study carried out by the Department of Health, City of Wrocław, in 2009 demonstrated that in the absence of alternative products in school shops, pupils substituted salty snacks or carbonated drinks with healthier options (Jarossová, 2013). And when schools attempted to organize shop assortments, some children simply walked to the nearest convenience store instead. This suggests that regulating unhealthy items isn't enough- unless the school provides real, affordable alternatives (Urbańska & Czarniecka-Skubina, 2007). Looking more broadly, epidemiological data hint that rural Polish children are exposed to unhealthy diets (Hamulka et al., 2018). They consume more sugary soft drinks, skip meals more often, and show higher rates of overweight and obesity than urban peers(Laitinen et al., 2023). That might sound counterintuitive, given assumptions about rustic diets. Reality is often full of highly processed foods, large amounts of sugar and salty snacks, while fresh produce is rare (Spronk et al., 2014). Adding the lack of structured meals, and these patterns deepen. Not infrequently, children arrive at school without breakfast, planning to buy something later- if they can (Commission/EACEA/Eurydice, 2018).

It is worth mentioning that education initiatives have tried to fill the gap(Hamulka et al., 2018). One such project, *ABC of Healthy Eating*, aimed to improve teenagers' nutrition knowledge. It has raised awareness, but encouraging children to choose healthier foods when such options are not provided remains a challenging task (Wadolowska et al., 2019). That disconnect between knowledge and action underscores the importance of accessibility.

From a policy angle, the absence of school canteens triggers equity concerns(Długoński et al., 2025;Ammann et al., 2023). If one school offers daily warm meals, and another doesn't, the system might reinforce social inequalities instead of mitigating them. Notably, older students wield more autonomy- they tend to buy cakes, salty snacks, or sugary drinks at school(Hamulka et al., 2024). Younger children seem more reliant on formal meals and, when available, express greater demand for canteen meals(Hawkins et al., 2021). That age-related shift suggests that a one-size-fits-all policy risks missing key needs: younger pupils need affordable canteen access, while interventions for older ones might have to reshape the school shopping culture.

On the European stage, institutions like WHO(WHO, 2006) and FAO (FAO, 2020) highlight the value of holistic school food systems. WHO's tools for developing country- specific school nutrition policies underscore early intervention and tailored strategies rather than one-size solutions. Meanwhile, FAO promotes "school food and nutrition" as interconnected with local agriculture, sustainability, and education- emphasizing that schools, when empowered, can foster healthier habits and support local food systems FAO (FAO, 2019). Moreover, new EU data shows that in the 2022– 2023 school year, school meal programmes reached 25 million children, with at least €12 billion invested (European Commision, 2025). Results suggest these services don't just feed kids- they yield long-term health benefits, bridge social gaps, and may deliver substantial economic returns (up to €34 per €1 invested). Still, the Polish experience shows that policies don't always play out equally in the reality (Długoński et al., 2025). Some municipalities invest in modern kitchen infrastructure; others outsource catering or lack resources- leading to diverse outcomes.All things considered, analysing the examples, the literature sketches a nuanced landscape. Structured school meals can benefit child health, learning, and equity- but only if they're accessible and consistent (Stoś et al., 2021). Educational programmes help, but lack bite without supportive infrastructure. Age plays a role- older students self-select into less healthy habits; younger children need structure. WHO and FAO reinforce that policy must be context-aware, drawing in education, environment, and even food systems. The present study takes up these research gap by analysing students behaviour from schools without canteens in rural areas in Poland.

Methods

The presented study constitutes a part of a broader research project devoted to the analysis of institutional and infrastructural determinants of providing food services in rural schools in Poland. Within that programme, the overarching comparative design juxtaposes primary schools operating canteen facilities with those that do not; the article at hand reports the analysis of the no-canteen stratum. The empirical component was conducted between

September and December 2023. The study was conducted among students from the Lower Silesian Voivodeship, a region characterised by marked disparities in rural infrastructure and varying potential for the provision of public services. The study decided to conduct analyses in rural schools in the Lower Silesian Voivodeship, which lack kitchen facilities, for several important reasons. Firstly, the demographic and educational structure of the region is representative of rural conditions in Poland, which suggests that the observed dietary patterns may also be typical for other provinces with similar socio-economic characteristics. Secondly, the selection of a single province allows for the control of environmental and organisational factors that could distort comparisons between schools, such as differences in local nutrition programmes or the availability of retail outlets. Finally, focusing the study on a single region allows for accurate and detailed observation of pupils' eating behaviours on a typical school day, which increases the reliability of the data obtained and facilitates its subsequent interpretation in a national context. Following a pilot of the research instrument, purposive quota sampling was applied to capture the diversity of food-service organisation. The final analytical sample included 266 pupils (grades IV– VIII) with returned and correctly completed questionnaires. The distribution of respondents is presented in Table 1.

Table 1. Characteristics of respondents by gender and age (number, %)

Specification		Number	%
Overall		266	100
Gender	Female	137	51.5
	Male	129	48.5
Age	10	5	1.9
	11	15	5.6
	12	25	9.4
	13	85	32.0
	14	90	33.8
	15	35	13.2
	16	11	4.1

Source: own study based on a survey conducted.

The analytic sample comprised pupils aged 10– 16 years (mean 13.31, SD 1.28), with a balanced gender distribution (129 boys, 137 girls; 48.5% vs. 51.5%). The distribution is concentrated in early adolescence, with the modal cohorts at 13 (≈85 pupils) and 14 years (≈90 pupils), and smaller tails at 10 (≈5), 11 (≈15), 12 (≈25), 15 (≈35), and 16 years (≈10). This structure justifies the a priori analytical split used throughout the paper- 10–12 vs. 13– 16 years- which yields a compact younger group (≈45 pupils) and a substantially larger older group (≈221 pupils). The grouping reflects developmental differences in food autonomy and purchasing behaviour noted earlier, and it also ensures sufficient cell sizes for the non-parametric/exact tests applied in subsequent analyses. The concentration at ages 13– 14 further explains why age- rather than gender- is emphasised in the hypothesis tests (e.g., shop purchases, stated demand for hot lunches), as it is the dimension along which meaningful variation is most likely to manifest in this no- canteen setting.

Because several inputs were cross-tabulations, some marginal totals exceeded N owing to table structure; such instances are indicated in the Results where relevant. Measures reflected the sociodemographic profile (age in years, gender) and in-school eating practices. The latter encompassed: bringing a second breakfast from home (yes/no); having a school shop on site (yes/no); making purchases at the school shop (yes/no); reporting any school-lunch consumption notwithstanding the absence of canteens (e.g., occasional or alternative provision) (yes/no); and stated demand for hot school lunches if they were to be offered (yes/no). Additional indicators captured dietary counts number of meals per day and number of hot meals per day. A supplementary item recorded taste assessments of school lunches for a limited subset and is summarised descriptively.

Statistical analysis was conducted with two-sided tests at $\alpha = 0.05$. Quantitative variables are reported as means, standard deviations, medians, quartiles, minima and maxima; qualitative variables are presented as absolute and percentage frequencies. Group comparisons followed the plan embedded in the source report: Pearson's χ^2 tests for categorical outcomes (with Yates' continuity correction for 2×2 tables and Fisher's exact test where expected counts were small) and Mann–Whitney U tests for continuous or ordinal outcomes. Given the aggregated nature of inputs and occasional sparsity of subgroup cells, the analysis emphasises effect directions and inference calibrated to the data structure.

The study addressed two research questions: (RQ1) what are the dominant in-school eating patterns among pupils in rural schools without canteens (second breakfast, school-shop purchases, reported lunch consumption, meal number); and (RQ2) what is the expressed demand for hot school lunches if offered, and does it vary by age group and gender. Correspondingly, three hypotheses were specified a priori: (H1) there is no association between gender and bringing a second breakfast from home; (H2) older pupils (13–16) are more likely than younger pupils (10– 12) to make purchases in the school shop; and (H3) the reported demand for hot school meals is higher among older pupils (13– 16 years old) than among younger pupils (10– 12 years old).

All data were anonymised and aggregated; no personal identifiers were present. Analytic caveats arise from the use of aggregated cross-tabulations, occasional sparse cells, and marginal totals that exceed N in some tables due to cross-tab structure. Where reconstruction was necessary (for example, aligning age-stratified and overall distributions), the conventions set in the provided report were followed and any departures are noted in the Results.

Results

First of all, analysis shows near-identical age profiles for girls and boys (both ≈13.3 years), indicating that the gender subgroups are well balanced with respect to age- a useful precondition for like-for-like comparisons later in the section (Figure 1).

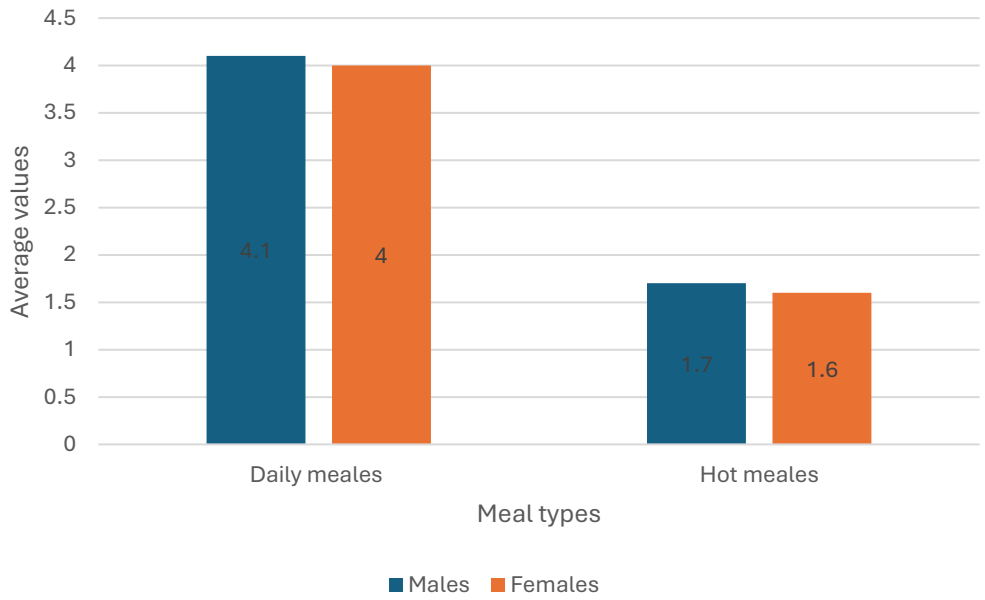

Figure 1. Mean daily meals and hot meals by gender

Source: own study based on a survey conducted.

Average meal numbers are also closely aligned across genders: pupils report roughly 4.1 meals/day for boys and ≈4.0 meals/day for girls, with hot meals averaging ≈1.7/day for boys and ≈1.6/day for girls. The absolute gaps (≈0.1 meals/day overall; ≈0.1 hot meals/day) are trivially small and not suggestive of substantive gender differentiation in baseline intake frequency during the school day. Moreover, all students eating behaviours checked by gender, have no statistically significant differences (Figure 2).

Figure 2. Radar plot of in-school eating indicators by gender (%)

Source: own study based on a survey conducted.

The polygons for boys and girls almost entirely overlap, indicating broad gender parity across the six indicators. First of all, roughly two-thirds of pupils in both groups bring a second breakfast. There is no association emerged between gender and bringing a second breakfast from home. The proportions were essentially identical (boys: 65.1%; girls: 65.7%); the Yates-corrected χ^2 was statistically insignificant ($p > 0.05$). H2, which posited no gender difference, is therefore supported. Secondly, the use of school lunch (where reported) remains low (≈15%). Thirdly, stated demand for hot school lunches sits around one-third for both genders, with only a marginal tilt that is not suggestive of a meaningful gap. The last but not least, the use of the school shop is the only variable where gender differences are visible with the proportion of boys in the structure was greater than that of girls (by a few percentage points).

What is very interesting, the analysis shows contrasts of school-shop use between younger pupils (10–12) and older pupils (13– 16) in schools without canteens (Figure 3).

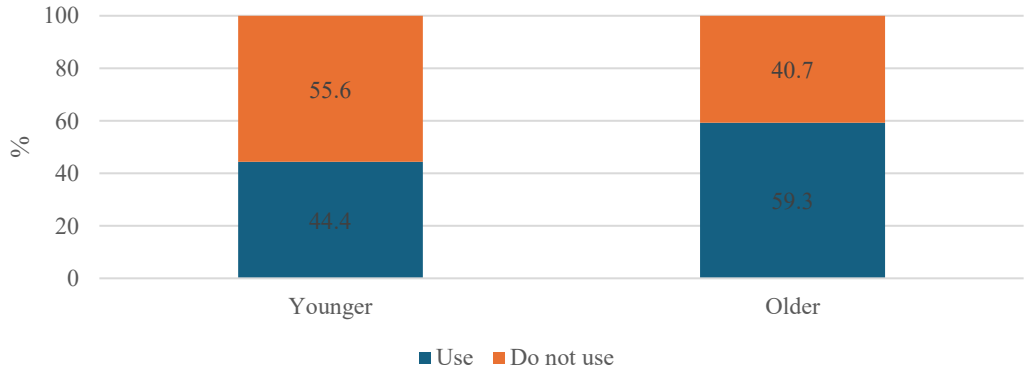

Figure 3. School-shop use by age group (%)

Source: own study based on a survey conducted.

The distribution is clearly age-graded: among younger pupils, roughly 44% report making purchases (≈20 of 45), whereas among older pupils the share rises to about 59% (≈130 of 221), a gap of ≈15 percentage points. Expressed as an association, the odds that an older pupil uses the shop are about 1.8× those of a younger pupil (OR ≈ 1.81). A Yates-corrected χ^2 test confirms that this difference is statistically significant at $\alpha = 0.05$, in line with H2. Substantively, the figure illustrates how increasing food autonomy with age translates into greater reliance on school shops shopping when formal lunch provision is absent. Furthermore, Figure 4 complements this pattern from the demand side: while H3 is not supported (younger pupils often than older ones, report willingness to take up hot lunches), the two figures together indicate an age-segmented provisioning landscape- older pupils gravitating toward shop purchases, younger pupils signaling latent demand for structured hot meals.

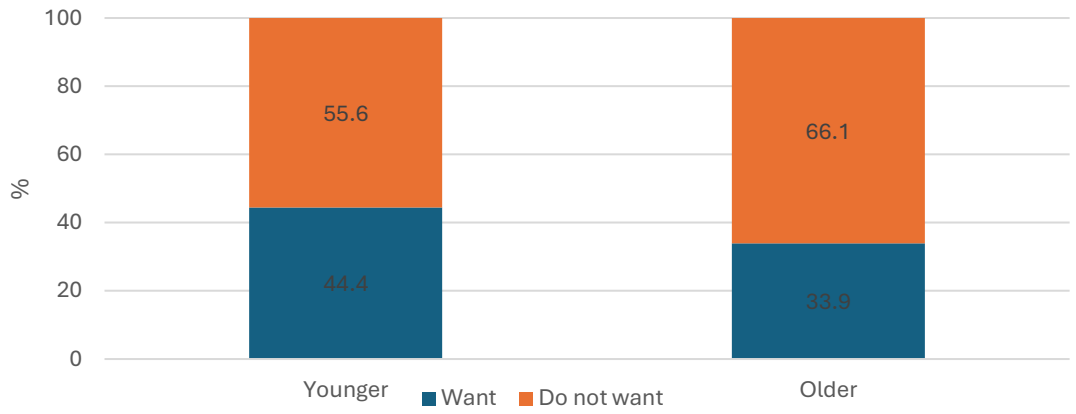

Figure 4. Stated demand for hot school lunches by age group (%)

Source: own study based on a survey conducted.

Among younger pupils (10–12; N= 45), 20/45 (44.4%) would take up hot lunches and 25/45 (55.6%) would not. Among older pupils (13–16; N= 221), 75/221 (33.9%) express demand and 146/221 (66.1%) do not. A Yates-corrected χ^2 test indicates that the difference is not statistically significant at $\alpha = 0.05$ (χ^2=2.089, df= 1).

In addition, the analysis shows, what are the dominant in school eating patterns among pupils in rural schools without canteens (RQ1). First of all, the average number of daily meals is similar (Figure 5).

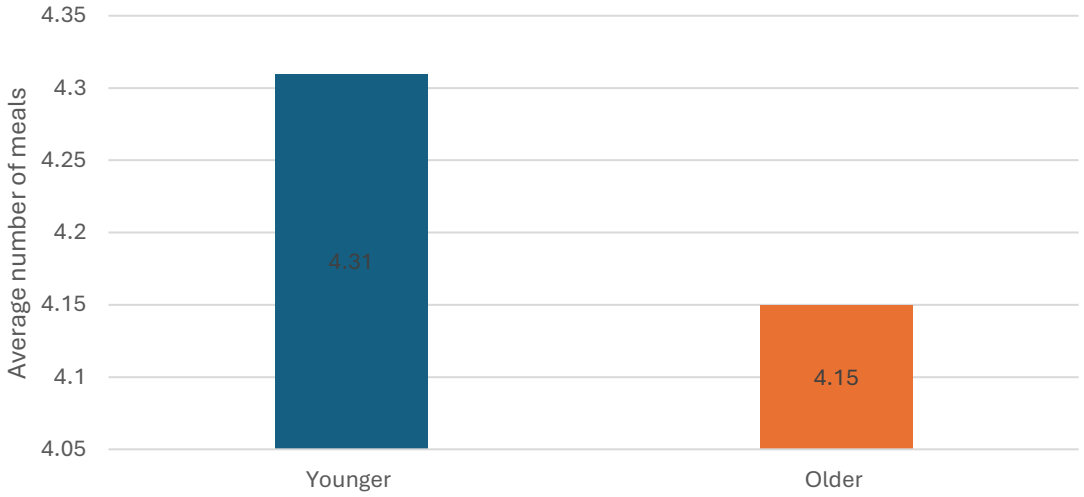

Figure 5. Mean number of daily meals age group

Source: own study based on a survey conducted.

Younger pupils (10– 12) report average 4.31 meals/day versus ≈4.15 meals/day among older pupils (13– 16). Medians are identical (4 in both groups; typical interquartile range ≈ 4–5), and the gap is small (Δ ≈ 0.16 meals/day) and not statistically significant on a Mann–Whitney test ($p > 0.05$). Moreover, the mean number of hot meals per day by age is also similar (Figure 6).

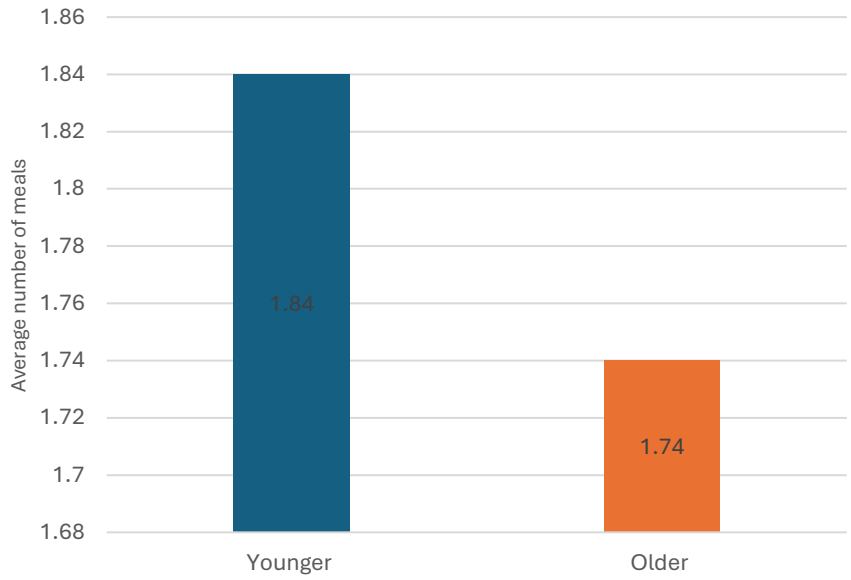

Figure 6. Mean number of hot meals by age group

Source: own study based on a survey conducted.

Younger pupils (10–12) report ≈1.84 hot meals/day, while older pupils (13– 16) report ≈1.74 hot meals/day; medians are identical (2 in both groups). The absolute gap is small (Δ≈0.10) and statistically non-significant on a Mann– Whitney test ($p>0.05$). Thirdly, the distribution of bringing a second breakfast to school by age is similar as well (Figure 7).

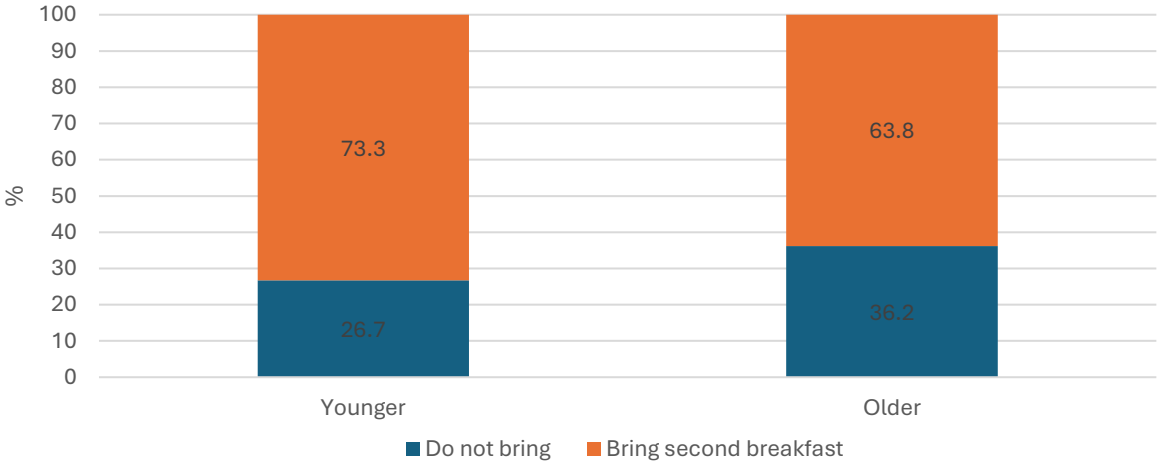

Figure 7. Bringing second breakfasts to school by age group (%)

Source: own study based on a survey conducted.

In the younger cohort (10–12; N= 45), 32/45 (73.3%) report bringing a second breakfast and 13/45 (26.7%) do not. In the older cohort (13–16; N= 221), 140/221 (63.8%) bring a second breakfast and 81/221 (36.2%) do not. The absolute difference between age groups is 7.8 percentage points, indicating a slightly higher prevalence of home-provided second breakfasts among younger pupils. Summary, this pattern reinforces earlier findings from Figures 5– 6: with meal cadence and hot-meal exposure broadly age-invariant, home provisioning- operationalised here as the second breakfast- functions as the primary anchor of school-day intake in settings without canteens.

The age gradient is modest and should be interpreted cautiously; nevertheless, it suggests that younger pupils rely marginally more on structured, home-prepared food, whereas older pupils' routines are more likely to incorporate discretionary purchases (as evidenced by shop use in Figure 3).

The last but not least, the research results indicate what is the expressed demand for hot school lunches if offered, and does it vary by age group and gender (RQ2). In the analytic sample (N = 266), 35.7% of pupils declared that they would want a hot school lunch if it were offered. Even if the difference is statistically not significant, the demand is higher among younger pupils (10– 12) than among older pupils (13– 16), as it was showed in Figure 4.

A 2×2 test with Yates' correction does not reach conventional significance (χ^2=2.089, df=1, p≥0.05), so the difference should be treated as suggestive but not conclusive in this sample. Moreover, stated demand for hot school lunches is also not structured by gender in this sample (Figure 8).

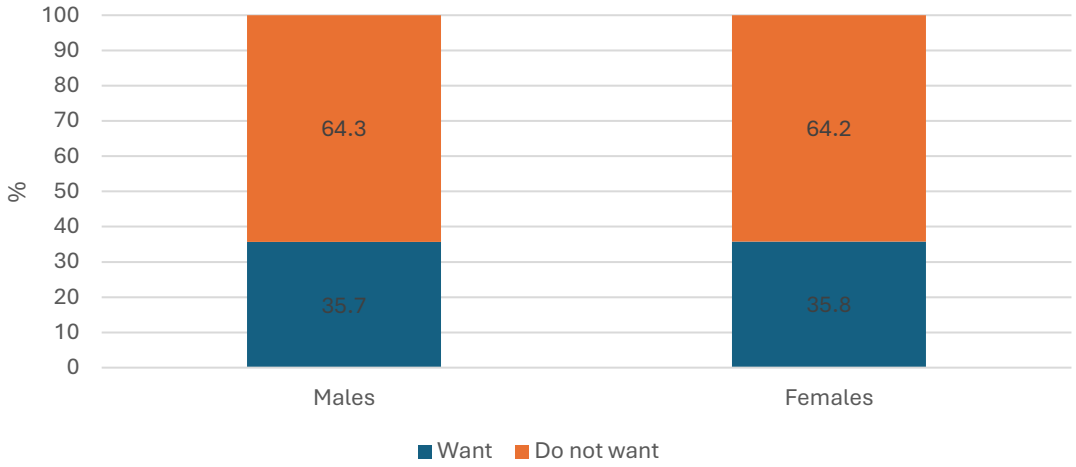

Figure 8. Demand for hot school lunches by gender (%)

Source: own study based on a survey conducted.

The bars are nearly parallel across genders: among boys, 35.7% report wanting lunches versus 64.3%, not wanting; among girls, 35.8% want versus 64.2% do not. This corresponds to proportions of ~35% (boys) and ~36% (girls). The difference is trivially small (≈0.1 pp) and consistent with a non-significant 2×2 test (Yates-corrected χ^2, p > 0.05). Taken together, the results indicate a stable, policy-relevant minority willing to take up hot lunches in schools without canteens. The age gradient- though not statistically conclusive- points to stronger latent demand among younger pupils, whereas gender does not appear to structure demand.

Discussion

The results of a study conducted among pupils of rural primary schools without canteens indicate a repetitive eating pattern during the school day, based primarily on meals brought from home, supplemented by purchases made at local retail shops. Most pupils bring a second breakfast, over half purchase items in the school shop, and minority report exposure to a lunch-type meal. Meals number is steady at roughly four meals per day (about two hot). Behavioral differences are structured predominantly by age rather than gender: older pupils are more likely to rely on retail purchasing, while younger pupils signal somewhat stronger willingness to take up hot lunches if offered (a gradient that is directional but not statistically conclusive in this sample). The frequency of meals appears adequate, yet the channels supplying those meals differ: home-packed food and discretionary purchases are the principal sources where canteen infrastructure is missing. The significant age effect in shop use is consistent with increasing autonomy in early adolescence and with the convenience- driven nature of purchasing under short breaks.

The age-segmented pattern justifies differentiated preferations. For the older cohort (13–16), priorities sit in the retail channel: minimum assortment standards aligned with dietary guidance, pricing and portion strategies that make healthier options the default value choice, placement and timing nudges (e.g., healthier items at point of sale, protected eating windows to reduce rushed purchases), and consistent access to drinking water. For the younger cohort (10–12), structured hot-lunch pilots are likely to align with stated preferences and to stabilise healthier routines. Even partial arrangements such as one hot component on specified days, can create predictable anchors for eating during the school day. Moreover, in low-infrastructure schools, incremental capital outlays can extend provision without the fixed costs of full kitchens. Examples include compact warming equipment, modular kitchenettes, shared serving points and small dining spaces that can be timetabled across classes. Where external catering is contemplated, procurement should weight nutritional specifications alongside logistics: temperature control, portioning, delivery windows that match rural transport realities, and transparent unit costs (including subsidies) to sustain participation. Clear information on allergens and special diets is integral to uptake and safeguarding. Furthermore, the indicator set used in this study: second breakfast prevalence, school- shop use, reported lunch exposure and meal counts, constitutes a practical dashboard for termly monitoring. Because each item is observable at school level, routine tracking can be embedded in existing administrative cycles with minimal burden. Disaggregation by age allows schools and municipalities to target actions where they are most likely to shift behaviour (e.g., reinforcing retail standards for older pupils, piloting hot meals where younger cohorts predominate).

Even though this study presents a snapshot of behaviour during the school day in a large rural sample, several important caveats should be mentioned. The design is cross-sectional and relies on pupil self-reports, so recall and social-desirability bias are possible. Inputs are aggregated cross-tabulations, limiting model complexity and occasionally producing denominators that vary across analyses. The younger age band is comparatively small, which reduces power to detect modest effects (relevant for the age gradient in stated demand).

Conclusions and Policy Implications

The study provides a quantitative portrait of in-school eating behaviors among pupils in rural Polish primary schools without canteen facilities. Across the analytic sample, meal cadence is stable, most pupils bring a second breakfast from home, and more than half make purchases in the school shop; only a minority report exposure to a lunch-type meal. Age, rather than gender, structures behavioral differences: older pupils are significantly more likely to rely on retail purchases, whereas younger pupils express higher- though not statistically conclusive- demand for hot lunches. Taken together, these patterns indicate that the main challenge in no-canteen settings is not whether pupils eat, but the nutritional profile of foods available and chosen during the school day. Analytically, the specify nature of the data constrains causal inference and limits precision for some subgroup contrasts (notably the smaller 10– 12 age band). Nevertheless, the indicators used here are reproducible at school level and reveal consistent, policy-relevant regularities that can guide pragmatic action in low-infrastructure environments.

Evidence from this study supports a dual, age-differentiated approach that prioritises feasible changes within existing constraints while testing scalable forms of provision:

- Introducing minimum assortment standards is school shops, which are aligned with dietary guidance. De-emphasizing high-sugar beverages and confectionery. Adjusting portioning and pricing so that healthier options represent the default value choice. Providing children with constant and free access to drinking water at school.
- Testing modular formats (e.g., one hot component on selected days) using compact warming equipment or simple kitchenettes where full kitchens are not feasible.
- Where external catering is used, weighting nutritional specifications alongside delivery windows, temperature control and portion sizes.
- Tracking, at least termly, the indicator set operationalised here—second breakfast prevalence, school-shop purchases, reported lunch exposure and meal counts—disaggregated by age group. Using results to adjust shop contracts and school breaks schedules.

All things considered, alasysing the example of this study, three main directions appear most valuable. First, pilot evaluations that phase in hot- lunch provision or enhanced retail standards across comparable rural schools would allow stronger inference on substitution, uptake and equity effects by age. Second, cost and logistics analyses are needed to identify delivery models (on- site preparation, external catering, on- site heating) that sustain high participation at viable price points. Third, comparative designs that include otherwise similar schools with

canteens would clarify how infrastructure shifts pupils away from snack-based diets toward structured meals and whether such effects persist as pupils age.

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