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Frequency and Determinants of Ultra-Processed Foods in the Lunchboxes of Under-12 Students in Urban Pakistan: A Cross-Sectional Survey

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ABSTRACT

Ultra-processed foods are taking the place of traditional foods in children's diets. As frequent consumption of UPFs during childhood is associated with many nutrition-related diseases, the evidence for the consumption of such foods by school-going children in Pakistan is limited. **Objectives:** To determine the frequency of ultra-processed foods in the lunchboxes of children under 12 years in densely populated cities of Pakistan and identify the demographic, socioeconomic, parental, and school-related factors that are associated with their inclusion. **Methods:** A cross-sectional survey was conducted among 287 parents of children aged 5–12 years from six major Pakistani cities. A bilingual questionnaire was used to check the contents in the lunchboxes, nutritional knowledge and label-reading practices of parents, and sociodemographic characteristics. Data were analyzed using descriptive statistics and Chi-square tests in SPSS version 26.0. To check significance, $p < 0.050$ was considered statistically significant. **Results:** It was reported that 59.9% of children frequently consumed ultra-processed foods. Higher UPF consumption was significantly associated with lower parental education, lower household income, limited nutrition knowledge, and infrequent nutrition label reading ($p < 0.050$). No significant associations were observed with child age, gender, school type, or grade level. **Conclusions:** The consumption of ultra-processed foods is very prevalent among Pakistani schoolchildren living in cities, strongly influenced by low socioeconomic status and poor nutritional literacy of parents. To encourage healthier lunchbox choices and reduce UPF intake, we need to focus on parents' nutrition education and making stronger nutritional policies in schools.

INTRODUCTION

Childhood is the most critical period for physical growth, cognitive development, and the establishment of a lifelong dietary behavior. The eating habits of a person are learned during the early years of life and often continue until adolescence and adulthood. These habits influence the risk of obesity, cardiovascular diseases, type 2 diabetes, and other non-communicable diseases, which are related to diet, later in life [1, 2]. As children spend a large portion of their day at school, the foods they consume during school hours play a good role in their daily nutrient and energy intake. In Pakistan, the trend of taking home-prepared lunchboxes to school is very common, like in other low- or

middle-income countries [3]. So, the nutritional quality of these lunchboxes plays an important role in overall quality of diet quality, nutritional status, and health outcomes [4]. Due to urbanization around the world, eating habits of children have been affected too. Those families where traditional foods were prepared at home are now also opting for convenience foods that are manufactured commercially. The main reason for their rising trends that they are less time-consuming, easily accessible, more affordable, and have strong marketing strategies [5]. Due to this transition in food trends, the consumption of ultra-processed foods (UPFs) is increasing in school-going



children living in cities too [6]. According to the NOVA food classification, ultra-processed foods are industrial formulations that are manufactured mainly from refined ingredients, food-derived substances, and cosmetic additives, usually left with no trace of whole foods [7]. The most common examples of ultra-processed foods from our daily lives are sugar-sweetened beverages, packaged snacks, confectionery, biscuits, instant noodles, processed meats, and commercially baked products. Unfortunately, almost all of these are frequently a part of children's lunchboxes [8]. Due to their easy access, these foods are now a great part of children's diet globally [9]. So, the increasing consumption of ultra-processed foods (UPFs) among school-aged children has become a growing public health concern because it is associated with poor diet quality, obesity in children, several micronutrient deficiencies, and an increased risk of non-communicable diseases [8, 10]. Pakistan has seen rapid urbanization during the past few decades, which has changed dietary patterns, and now we can see a wide availability of packaged foods. It is alarming, as have likely contributed to the increasing presence of UPFs in children's school lunchboxes.

However, despite this nutritional transition, evidence on the frequency of UPFs in lunchboxes and the factors influencing their inclusion among Pakistani schoolchildren remains limited. This knowledge gap restricts the development of evidence-based school nutrition policies and targeted interventions to promote healthier eating practices. Therefore, the present study aimed to determine the frequency of ultra-processed foods in the lunchboxes of children aged under 12 years attending urban schools in Pakistan and to identify the demographic, socioeconomic, parental, and school-related factors associated with their inclusion.

METHODS

It is a cross-sectional study, as a school-based survey was conducted from December 2025 to February 2026 to determine the frequency and determinants of ultra-processed foods (UPFs) in the lunchboxes of under-12 students in urban Pakistan. This study was done at the University of Management and Technology, Lahore. A total of 287 parents/guardians of children aged 5-12 years (Preschool – Grade 6) were questioned through a mixed non-probability sampling approach. Due to logistical feasibility, time constraints, and accessibility. Parents/guardians within each participating school were randomly selected using a random number generator. Six cities of Pakistan (Karachi, Lahore, Islamabad, Rawalpindi, Peshawar, and Quetta) were purposively selected for geographic representation, while schools within each city were chosen via convenience sampling due to logistical

feasibility, time constraints, and accessibility. Random selection of parents/guardians within the selected schools was employed to minimize selection bias. The children who had any chronic metabolic disease or food allergies and required a strict therapeutic diet were excluded from the study. Data were collected using a structured, self-administered questionnaire, available in both English and Urdu, which assessed child characteristics, parental sociodemographic characteristics, lunchbox practices, frequency of 20 food items (10 healthy and 10 UPFs classified according to the NOVA system) over the past five school days, factors influencing lunchbox choices, and parental nutrition knowledge and label-reading practices [8]. Data were collected via paper-based questionnaires in government schools and online Google Forms in private schools, with the mode chosen based on school administrative preferences and internet accessibility. To minimize mode effects, both versions used identical questions, response formats, and instructions, with written informed consent obtained from all participants [11]. The sample size was calculated using the single population proportion formula: $n = Z^2 p(1-p) / d^2$. Assuming a 50% prevalence of UPF consumption to maximize sample size, a 95% confidence level ($Z=1.96$), and a 6% margin of error ($d=0.06$), the minimum required sample was 267. Inflating by 10% to account for non-response, a target of 294 was set; however, 287 parents/guardians completed the questionnaire, yielding a final response rate of 97.6%, which exceeded the minimum required sample size.

Data were analyzed using SPSS version 26.0. Descriptive statistics (frequencies, percentages, means) and inferential statistics. Chi-square tests were used to explore the bivariate relationships between UPF consumption and sociodemographic/parental characteristics. A multivariable logistic regression model with forward stepwise (likelihood ratio) entry was used to determine factors independently associated with daily UPF consumption. The variables with $p < 0.20$ in bivariate analysis (maternal education, paternal education, monthly income, received healthy information, and nutrition label reading) were entered as candidates. Odds ratios (OR) with 95% confidence intervals (CI) were adjusted. A p -value of <0.050 was considered statistically significant.

RESULTS

There were no statistically significant differences for daily UPF consumption with any of the demographic factors related to children: age ($p=0.389$), gender ($p=0.351$), school type ($p=0.632$) and grade level ($p=0.920$). These results are not indicative of differences in UPF consumption among these subgroups; however, non-significant p -values do not indicate statistical equivalence. The absence of any significant association does not mean that there was equal uptake of UPF in each of the groups, but rather that it was

not possible to determine that there was equal uptake (Table 1).

Table 1: Association of Daily Use of Ultra-Processed Foods with Child Characteristics

Variable	Category	UPF Daily (n=172), n (%)	No UPF Daily (n=115), n (%)	χ^2	df	p-value
Child's Age	5-7 Years	68 (57.6%)	50 (42.4%)	1.89	2	0.389
	8-10 Years	85 (63.4%)	49 (36.6%)			
	11-12 Years	19 (54.3%)	16 (45.7%)			
Child's Gender	Male	93 (62.4%)	56 (37.6%)	0.87	1	0.351
	Female	79 (57.2%)	59 (42.8%)			
School Type	Government	58 (58.0%)	42 (42.0%)	0.23	1	0.632
	Private	114 (61.0%)	73 (39.0%)			
Grade Level	Class 1-3	95 (60.1%)	63 (39.9%)	0.01	1	0.920
	Class 4-6	77 (59.7%)	52 (40.3%)			

Daily UPF consumption was significantly higher among children whose parents had lower education (mothers: 68.0% vs. 55.6%, $p=0.022$; fathers: 67.4% vs. 56.7%, $p=0.042$) and lower household incomes (<100,000 PKR: 65.9% vs. 55.1%, $p=0.038$). Furthermore, parents who were not informed about healthy lunchboxes and parents who rarely or never read nutrition labels were significantly more likely to pack UPFs than other parents ($p<0.001$). The link between socioeconomic status and children's diet patterns is very strong, and low health literacy among parents is linked with children's diet patterns (Table 2).

Table 2: Association of UPF Daily Use with Parental Factors, Nutrition Knowledge and Practices

Variable	Category	UPF Daily (n=172), n (%)	No UPF Daily (n=115), n (%)	χ^2	df	p-value
Parent Relation	Mother	125 (58.1%)	90 (41.9%)	1.78	2	0.411
	Father	38 (66.7%)	19 (33.3%)			
	Guardian	9 (60.0%)	6 (40.0%)			
Mother's Education	$\leq$ Secondary	68 (68.0%)	32 (32.0%)	5.22	1	0.022*
	$\geq$ Intermediate	104 (55.6%)	83 (44.4%)			
Father's Education	$\leq$ Secondary	58 (67.4%)	28 (32.6%)	4.15	1	0.042*
	$\geq$ Intermediate	114 (56.7%)	87 (43.3%)			
Mother's Employment	Homemaker	115 (61.5%)	72 (38.5%)	0.67	1	0.413
	Employed	57 (57.0%)	43 (43.0%)			
Monthly Income	< 100,000 PKR	85 (65.9%)	44 (34.1%)	4.31	1	0.038*
	$\geq$ 100,000 PKR	87 (55.1%)	71 (44.9%)			
Received Healthy Info	Yes	48 (48.0%)	52 (52.0%)	11.84	1	<0.001*
	No	124 (66.3%)	63 (33.7%)			
Read Nutrition Labels	Always/Sometimes	55 (47.8%)	60 (52.2%)	12.94	1	<0.001*
	Rarely/Never	117 (68.0%)	55 (32.0%)			

Private school children were significantly more likely to have healthy items in their lunchboxes, including fresh fruit (95.2% vs. 80.0%, $p<0.001$), raw vegetables (67.9% vs. 45.0%, $p<0.001$), and boiled eggs (75.4% vs. 60.0%, $p=0.006$). There were no significant differences, however, between government and private schools for ultra-processed foods like packaged biscuits ($p=0.560$), packaged chips ($p=0.162$), and processed meats ($p=0.604$). This means that although there are healthier alternatives in private schools, there was no significant difference in the consumption of UPF between both school systems (Table 3).

Table 3: Association of School Type with Food Items

Food Item	Government School (n=100), n (%)	Private School (n=187), n (%)	χ^2	df	p-value
Packaged Biscuits	82 (82.0%)	148 (79.1%)	0.34	1	0.560
Fresh Fruit	80 (80.0%)	178 (95.2%)	16.20	1	<0.001*
Chapati/Paratha	95 (95.0%)	178 (95.2%)	0.01	1	0.920
Raw Vegetables	45 (45.0%)	127 (67.9%)	14.43	1	<0.001*
Packaged Chips	70 (70.0%)	145 (77.5%)	1.96	1	0.162
Plain Milk	75 (75.0%)	155 (82.9%)	2.57	1	0.109
Boiled Egg	60 (60.0%)	141 (75.4%)	7.41	1	0.006*
Processed Meats	38 (38.0%)	77 (41.2%)	0.27	1	0.604

Lower household income was significantly associated with higher consumption of multiple UPF categories, including packaged chips (83.7% vs. 67.7%, $p=0.001$), instant noodles (60.5% vs. 41.8%, $p=0.001$), soft drinks (52.7% vs. 38.6%,

$p=0.016$), packaged biscuits (85.3% vs. 75.9%, $p=0.042$), and sugar-sweetened juices (71.3% vs. 60.1%, $p=0.043$). The number of chocolate/candy consumption did not vary by income ($p=0.228$). This reinforces that low socio-economic children consume UPFs disproportionately, and at higher rates, than other children, and that these are affordable and shelf-stable (Table 4).

Table 4: Association of Income Level with Specific UPF Items

UPF Item	Income <100,000 (n=129), n (%)	Income ≥100,000 (n=158), n (%)	χ^2	df	P-value
Packaged Chips	108 (83.7%)	107 (67.7%)	10.15	1	0.001*
Packaged Biscuits	110 (85.3%)	120 (75.9%)	4.12	1	0.042*
Chocolate/Candy	95 (73.6%)	106 (67.1%)	1.45	1	0.228
Sugar-Sweetened Juice	92 (71.3%)	95 (60.1%)	4.10	1	0.043*
Soft Drinks	68 (52.7%)	61 (38.6%)	5.84	1	0.016*
Instant Noodles	78 (60.5%)	66 (41.8%)	10.34	1	0.001*

After adjusting for all confounders, infrequent nutrition label reading (aOR=2.78) and lack of healthy lunchbox information (aOR=2.56) emerged as the strongest independent predictors of daily UPF consumption. Lower maternal education (aOR=2.14) and low household income (aOR=1.89) also independently increased the odds of UPF intake. Paternal education lost statistical significance after adjustment (aOR=1.52, $p=0.168$), indicating its effect is largely mediated through maternal factors and income. Overall, modifiable health literacy factors demonstrate the most substantial independent influence on children's dietary habits, highlighting key targets for intervention (Table 5).

Table 5: Multivariable Logistic Regression Analysis of Factors Associated with Daily UPF Consumption

Variables	Category	aOR	95% CI	P-value
Mother's Education	≤ Secondary	2.14	1.18-3.89	0.012*
	≥ Intermediate (ref)	1.00		
Monthly Income	<100,000 PKR	1.89	1.06-3.37	0.031*
	≥100,000 PKR (ref)	1.00		
Received Healthy Info	No	2.56	1.45-4.52	0.001*
	Yes (ref)	1.00		
Read Nutrition Labels	Rarely/Never	2.78	1.58-4.89	<0.001*
	Always/Sometimes (ref)	1.00		
Father's Education	≤ Secondary	1.52	0.84-2.75	0.168
	≥ Intermediate (ref)	1.00		

DISCUSSION

The findings of this study reveal that nearly 60% of children aged between 5 and 12 years consume UPFs daily in their school lunchboxes. These results show that the nutrition transition is occurring in low- and middle-income countries (LMICs), and they also highlight that interventions can help promote healthy dietary practices among school-aged children [12]. One of the current major findings, that 59.9%

of children daily used to consume UPFs, is concerning. It aligns with global trends which show penetration of ultra-processed products into children's diets [13]. A recent systematic review examined UPF consumption and health outcomes in pediatric populations and also found that constant intake of UPFs significantly impacts nutritional status and body composition [6]. A study from Malawi, an African country, also reported that there is an alarmingly high UPF consumption among school-aged children, with significant associations between UPF intake and malnutrition outcomes [14]. Data from the South Asia Biobank indicate that approximately 41% of Pakistani adults reported consuming UPFs [15]. The higher prevalence observed among children in the current study (59.9%) is particularly concerning, as it indicates that UPFs have become even more embedded in children's diets than in adult populations. The current study found that daily UPF consumption was high across all groups of children in the current sample, regardless of their age, gender, school type, or grade. This suggests that eating ultra-processed foods has simply become a normal part of daily life for urban children from all backgrounds [12]. This study suggests that socioeconomic status plays a major role in UPF consumption. Children from families earning less than 100,000 PKR per month and those whose parents had less formal education were eating UPFs almost every day. This pattern is not only in Pakistan; it is seen worldwide [16]. Children from poorer families everywhere end up eating more ultra-processed foods and fewer healthy options [17]. For example, a study in Bangladesh showed that children from poorer households consumed more packaged snacks and sugary beverages [17]. Children whose mothers had only secondary education or less were especially at risk, as 68% of them consumed UPFs daily, as compared to 55.6% of children of more educated mothers. This gap is probably due to some factors like very limited knowledge about nutrition, trouble understanding food labels and marketing claims, and budget issues that make cheap and long-lasting UPFs like chips, instant noodles, biscuits, and sugary drinks a more convenient choice for lunchboxes [18, 19]. One of the most shocking things this study found was the power of nutrition knowledge and label-reading. Parents who had been given information about healthy lunchboxes were far less likely to pack UPFs daily as compared to those who hadn't. Also, those who used to read labels regularly had better food choices to pack their children's lunchboxes. This tells us that health literacy really matters when it comes to food choices, and our findings support what earlier research has already shown [20]. It's important to point out that label-reading itself depended a lot on socioeconomic background. Parents who were more educated and those with higher incomes were more likely to read labels. So, it looks like health

literacy is one of the key ways that wealthier families end up making healthier food choices. When the current study compared government and private schools, we found that children from private schools were much more likely to have healthier items in their lunchboxes, like fresh fruit, salads, and boiled eggs. But when researchers studied ultra-processed food consumption, their results were almost the same, as children from both types of schools were consuming them. But in private schools, healthy items and UPFs often appear together in the same lunchbox. This really highlights how complicated modern eating patterns have become as traditional foods and convenience products are now mixed in daily meals [21]. Food habits are not just a childhood issue; the current study found that university students were also making poor choices, with many regularly turning to energy drinks to get through their studies. It seems that once these dietary patterns take root early on, they carry through to later years [22]. So, there are two very important policy implications. One is to make healthy food affordable through subsidies on fruits and vegetables [15]. And, this study should prioritize practical education for parents to help them recognize UPFs, understand labels, and shop more wisely [23, 24]. Also, since UPFs are just as common in government schools as they are in private ones, this study needs to think about regulation, which means that there should be restrictions on the marketing of UPFs by adding warning labels on the front of packages. Food policies in the schools should also be regulated [8]. A strength of this study is that it gathers data from six cities of Pakistan, which ensures diversity. Also, an internationally recognized NOVA food classification system was used.

However, a few limitations are also present. The cross-sectional design limits causal inference. Also, data were self-reported by parents, which may introduce recall and social desirability bias. Convenience sampling also restricts generalizability to the broader population. Future studies should include longitudinal designs and objective dietary assessment systems.

CONCLUSIONS

In conclusion, this study reveals that around 60% of urban Pakistani schoolchildren consume ultra-processed food on a daily basis. Its key determinants are lower socioeconomic status, limited parental education, and poor nutrition knowledge. These findings show that there is a dual burden, as lower-income families face both financial issues and have very limited health literacy. To address this challenge, we need to provide nutrition education, launch label literacy programs, and make policies in schools to target the availability of ultra-processed foods.

Author's Contribution

Conceptualization: SR

Methodology: SR

Formal analysis: SR

Writing and Drafting: SR

Review and Editing: SR

The author approves the final manuscript and takes responsibility for the integrity of the work

Conflicts of Interest

The author declares no conflict of interest.

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