Section: Community Medicine

Original Research Article

ASSOCIATION OF ULTRA-PROCESSED FOOD CONSUMPTION WITH ILLNESS AND HEALTH COMPLAINTS IN CHILDREN AGED 2 TO 6 YEARS IN AMRITSAR DISTRICT: AN URBAN-RURAL CROSS-SECTIONAL STUDY

Sanjeev Mahajan[1], Aashima M. Singh[2], Preeti Padda[3], Jasleen Kaur[4], Ishaan Khanna[5]

[1]*Professor & Head, Department of Community Medicine, Government Medical College, Amritsar, India.*
[2]*Junior Resident, Department of Community Medicine, Government Medical College, Amritsar, India.*
[3]*Professor, Department of Community Medicine, Government Medical College, Amritsar, India.*
[4]*Associate Professor, Department of Community Medicine, Government Medical College, Amritsar, India.*
[5]*Intern, Government Medical College, Amritsar, India.*

Received *: 12/07/2025*
Received in revised form *: 02/09/2025*
Accepted *: 18/09/2025*

Corresponding Author:
Dr. Aashima M Singh,
Junior Resident, Department of Community Medicine, Government Medical College, Amritsar, India.
Email: aashima.singh231093@gmail.com

DOI: 10.70034/ijmedph.2025.4.240

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (4); 1344-1348

ABSTRACT

Background: The global rise in ultra-processed food (UPF) consumption is displacing traditional diets, contributing to a dual burden of malnutrition and obesity. In India, rapid urbanization, economic growth and aggressive marketing have driven a surge in UPF availability and consumption. Early childhood dietary patterns, strongly influenced by maternal knowledge, attitude and practices (KAP), play a critical role in shaping long-term health. This study aimed to assess UPF inclusion in the diets of children aged 2 to 6 years in urban and rural areas of Amritsar district and examine its association with common health complaints.

Materials and Methods: A community-based, descriptive cross-sectional study was conducted from 1st August 2023 to 31st July 2024 among 300 mother-child dyads (150 urban, 150 rural) selected via consecutive sampling. Data was collected using a pre-tested semi-structured questionnaire assessing sociodemographic profile, maternal dietary KAP, UPF consumption and child health status. UPF consumption was quantified using the NOVA classification with frequency scoring over the prior week. Associations between UPF consumption and health complaints were analysed using chi-square, t-tests, ANOVA and Pearson's correlation, with $p<0.05$ considered significant.

Results: Among the study participants, 59% were boys and the mean age was 3.5 ± 1.22 years. Frequent consumption was observed for UPF food items such as potato chips (45%), flavoured milk (39%) and sweetened beverages (29%). Higher UPF consumption scores were significantly associated with frequent stomach pain (p=0.038), constipation (p=0.027), crankiness/irritability (p=0.046) and frequent episodes of diarrhoea (p=0.023) and upper respiratory tract infections (p=0.028) in the last six months. Lower maternal dietary KAP scores correlated with higher child UPF intake across both urban and rural settings.

Conclusions: Frequent UPF consumption is linked to higher prevalence of gastrointestinal, respiratory and behavioural complaints in children. Higher UPF consumption is associated with lower maternal dietary knowledge, attitude and practices. Interventions regarding nutritional education of mothers and strategies to limit UPF access would improve child health outcomes.

Keywords: Ultra-processed food, NOVA classification, urban- rural, Amritsar, maternal dietary knowledge, attitude, practices, child health, gastrointestinal complaints, respiratory infections.

INTRODUCTION

Childhood nutrition is undergoing a dramatic transformation worldwide, driven by the rapid rise in consumption of ultra-processed foods which are designed for convenience and hyper-palatability. The NOVA classification system categorizes food into four groups based on the degree of processing: Group 1 consists of unprocessed or minimally processed foods, Group 2 has culinary ingredients, Group 3 includes processed foods and Group 4 comprises of ultra-processed foods (UPFs). UPFs are defined as industrial formulations comprising little or no intact whole foods and containing additives such as colourants, emulsifiers and flavour enhancers.[1] Globally, UPFs account for over 50% of total caloric intake in high-income countries and are increasingly displacing traditional, minimally processed diets in low- and middle-income settings.[2]

In India, economic growth, urbanization and aggressive marketing have fuelled a surge in UPF sales from USD 0.9 billion in 2006 to USD 37.9 billion in 2019.[3] This shift has contributed to a dual burden of malnutrition among children, with undernutrition and micronutrient deficiencies coexisting alongside rising overweight and obesity rates.[4] Frequent UPF consumption is linked to adverse health outcomes including gastrointestinal disturbances, increased infection rates and long-term risks of non-communicable diseases such as type 2 diabetes and hypertension.[5]

Early childhood dietary patterns critically influence long-term health outcomes, with maternal knowledge, attitude and practices (KAP) functioning as pivotal determinants of nutritional behaviours and well-being of child. The objective is to assess the inclusion of ultra-processed foods (UPFs) in the diet of children aged 2 to 6 years in urban and rural areas of Amritsar district and examine its association with health issues in the children.

MATERIALS AND METHODS

A community based, descriptive cross-sectional study was conducted between 1 August 2023 and 31 July 2024 under the Department of Community Medicine, Government Medical College, Amritsar. Nag Kalan village and Mustafabad slum were selected through simple random sampling and the study participants were selected through consecutive sampling. The sample comprised of 300 mother-child dyads, 150 each from rural and urban areas. Children aged 2 to 6 years and their mothers who gave informed consent were included in the study. The exclusion criteria included refusal by mother to provide informed consent and the presence of congenital anomalies, serious illness or intellectual disability in the child.

Data was collected via semi-structured, pre-tested questionnaire covering (A) Sociodemographic profile (B) Maternal dietary knowledge, attitude and practices (C) Dietary Pattern of child based on NOVA Classification and (D) Health status of child (health complaints and episodes of illness).

Consumption of various food items was assessed using the NOVA classification and frequency of intake of 15 UPF items over the prior week was recorded. Score of 0 to 3 was given per food item where 0 = not consumed and 3= consumed 4 to 7 times over past one week, yielding a total score ranging from 0 to 45.

Health complaints and episodes of illness in children were recorded and classified for evaluating association with UPF consumption. "Frequently" was defined as health complaints occurring daily or multiple times per week with significant interference in the child's normal activities or school attendance. "Occasionally" was classified as complaints occurring weekly to monthly with some impact on daily functioning. "Rarely" was defined as complaints occurring less than monthly with minimal impact on daily activities.

Data was compiled in MS Excel and analysis was performed using SPSS version 26. Normality of data distribution was assessed by the Kolmogorov–Smirnov test. Descriptive statistics were reported as Mean ± Standard Deviation or Median ± Interquartile Range depending on data distribution. Associations were tested using chi-square test, t-tests, ANOVA and Pearson's correlations, considering p-value of <0.05 as significant.

RESULTS

Sociodemographic Profile

Among 300 children taken as study participants with mean age 3.5 ± 1.22 years, the largest age-group overall was 2–3 years old (32%), having similar proportions in urban (33%) and rural (31%) settings. The oldest group (5 to 6 years) was slightly more represented in rural areas (31%) than urban (29%). The 3 to 4 years age group comprised 21% of urban and 22% of rural children, while the 4 to 5 years group comprised of 17% urban and 16% rural children. Boys comprised a greater share of rural participants (63%) than urban (56%).

Majority of the mothers taken as study participants in both rural and urban areas were aged ≤ 25 years. Educational attainment was highest at the intermediate level and above, with 43% of urban and 41% of rural mothers, followed by up to 10th standard (41% urban, 33% rural). Education up to 5th standard was notably more common in rural areas (18%) as compared to urban (9%), while illiteracy remained low across both settings (7-8%). Regarding occupation of the study participants, 81% of urban mothers versus 55% of rural mothers were housewives.

Ultra-processed food consumption

Ultra-processed food consumption was assessed by recording frequency of consumption in a week of a 15-item list of ultra-processed food based on NOVA

classification (Table 1). UPF consumption was found to be universal among the 300 children studied. Potato chips demonstrated the most frequent consumption (45%), flavored milk ranked second (39%), followed by sauce/mayonnaise (30%), packed fruit juice (29%) and sweet carbonated drinks (29%). These findings indicate that savoury snacks, flavoured dairy products and sweetened beverages constitute the most frequently consumed ultra-processed foods in the study population.

A comparative box-and-whisker plot illustrating the distribution of ultra-processed food (UPF) consumption scores among children, stratified by residential location (rural vs. urban) and the combined total population has been shown in Figure 1. The UPF consumption scores demonstrate notable variations between geographical populations. The rural population exhibited the highest median UPF consumption score at 24, with an interquartile range (IQR) spanning from 22 to 27. Urban children demonstrated lower UPF consumption patterns, with a median score of 20 and a more compact distribution (IQR: 18-22). The analysis of total study participants revealed a median UPF consumption score of 22, with an IQR of 19 to 25.

Health Complaints and Illness Episodes

A comprehensive analysis of health complaints and illness history among 300 children, stratified by residential location (urban n=150, rural n=150), with chi-square analysis examining urban-rural differences across five key health indicators was done (Table 2). 60% of children experienced stomach pain either frequently or occasionally, indicating a substantial burden of gastrointestinal discomfort. Rural children reported frequent stomach pain (23%) slightly more than urban children (19%). Behavioural irritability showed notable variation between populations, with rural children demonstrating higher rates of cranky/irritable behaviour (19%) as compared to urban children (12%). In the past six months, 24% of urban and 28% of rural study participants had > 5 episodes of diarrhoea (p = 0.43). For upper respiratory tract infection, 31% of urban and 37% of rural participants had > 5 episodes (p = 0.27).

As shown in Table 3, study participants who frequently complained of stomach pain had significantly higher UPF consumption than those who reported it rarely (p = 0.038). Similarly, participants complaining of frequent constipation consumed significantly more UPFs (p = 0.027). Children described as cranky or irritable had higher UPF consumption (p = 0.046). Study participants reporting >5 diarrhoeal episodes in the past six months consumed more UPFs (p = 0.023). Children among study participants with > 5 upper respiratory tract infections similarly had greater UPF intake than children with ≤ 5 infections (p = 0.028).

Table 1: Distribution of study participants (children) according to ultra-processed food consumption in the past one week

Food Items	4-7 times	2-3 times	Once	Not consumed
Sandwich bread	62 (21)	99 (33)	95 (32)	44 (15)
Packed fruit juice	87 (29)	123 (41)	33 (11)	57 (19)
Flavored milk	116 (39)	99 (33)	49 (16)	36 (12)
Jam	48 (16)	66 (22)	89 (30)	97 (32)
Potato chips	135 (45)	97 (32)	45 (15)	23 (8)
Biscuits	86 (29)	117 (39)	63 (21)	34 (11)
Flavored cereal	54 (18)	95 (32)	87 (29)	64 (21)
Cheese/packed butter	84 (28)	96 (32)	84 (28)	36 (12)
Sauce/mayonnaise	90 (30)	107 (36)	76 (25)	27 (9)
Cake/pastry/ice-cream	46 (15)	64 (21)	82 (27)	108 (36)
Sweet carbonated drinks	87 (29)	113 (38)	71 (24)	29 (10)
Chocolates/Candies	72 (24)	110 (37)	88 (29)	30 (10)
Patties/samosa	85 (28)	110 (37)	63 (21)	42 (14)
Nuggets/Tikki	46 (15)	85 (28)	57 (19)	112 (37)
Pasta/Noodles	77 (26)	101 (34)	106 (35)	16 (5)

(Figures in parenthesis are percentages)

Table 2: Distribution of study participants (children) according to their health complaints and illness episodes

VARIABLE	Urban (n=150)	Rural (n=150)	Total (N=300)	Chi-square (p-value; df)
Complain of stomach pain				
Frequently	28 (19)	35 (23)	63 (21)	1.66 (0.44; 2)
Occasionally	53 (35)	63 (42)	116 (39)	
Rarely	69 (46)	52 (35)	121 (40)	
Complain of constipation				
Frequently	35 (23)	27 (18)	62 (21)	1.71 (0.43; 2)
Occasionally	42 (28)	44 (29)	86 (29)	
Rarely	73 (49)	79 (53)	152 (51)	
Child cranky/irritable				
Yes	18 (12)	29 (19)	47 (16)	3.31 (0.07; 1)
No	132 (88)	121 (81)	253 (84)	
Episodes of diarrhoea in last six months				

≤5	114 (76)	108 (72)	222 (74)	0.62 (0.43; 1)
>5	36 (24)	42 (28)	78 (26)	
Episodes of upper respiratory tract infection in last six months				
≤5	104 (69)	95 (63)	199 (66)	1.21 (0.27; 1)
>5	46 (31)	55 (37)	101 (34)	

(Figures in parenthesis are percentages)
p-value of <0.05 is considered to be significant

Table 3: Association of UPF consumption score with illness and health complaints in study participants (children)

Variable	UPF consumption score Mean ± SD	f-statistic/t-value p-value
Complain of stomach pain		
Frequently	22.97 ± 4.27	f = 3.30 **p = 0.038**
Occasionally	22.38 ± 3.74	
Rarely	21.45 ± 4.15	
Complain of constipation		
Frequently	23.01 ± 3.95	f= 3.67 **p = 0.027**
Occasionally	22.31 ± 4.31	
Rarely	21.56 ± 3.93	
Child cranky/irritable		
Yes	23.21 ± 3.51	t = 2.01 **p = 0.046**
No	21.93 ± 4.12	
Episodes of diarrhea in last six months		
≤5	21.82 ± 4.07	t = –2.29 **p = 0.023**
>5	23.03 ± 3.88	
Episodes of upper respiratory tract infection in last six months		
≤5	21.76 ± 3.88	t = –2.21 **p = 0.028**
>5	22.85 ± 4.30	

p-value of <0.05 is considered to be significant

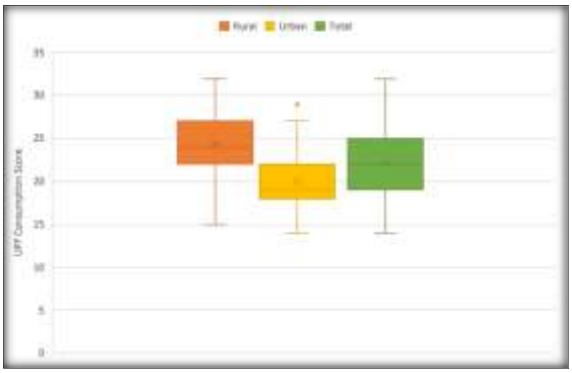

Figure 1: Distribution of study participants (children) based on UPF consumption score in the past one week

DISCUSSION

This cross-sectional study among 300 mother-child dyads in Amritsar district provides novel insights into the relationship between maternal dietary knowledge, attitude and practices (KAP) and children's ultra-processed food (UPF) consumption. The high prevalence of certain UPF items-potato chips (45%), flavoured milk (39%) and sweetened beverages (29%)- reflects concerning global trends where UPFs account for more than 60% of total caloric intake in high-income countries.[2,6] This pattern is particularly alarming, given India's rapid economic transition and the surge in sales of ultra-processed food (UPF) items.

The significant associations between high UPF consumption and child health complaints align with expanding evidence linking UPFs to adverse health outcomes across multiple physiological systems. The gastrointestinal disturbances observed namely, stomach pain (p=0.038), constipation (p=0.027) and diarrhoea (p=0.023) are consistent with evidence demonstrating that ultra-processed food items fundamentally alter gut microbiome composition.[7] UPFs promote gut dysbiosis marked by decreased microbial diversity and reduced beneficial bacteria such as Akkermansia muciniphila and Faecalibacterium prausnitzii.[8] These microbial alterations contribute to increased intestinal permeability, allowing bacterial endotoxins to enter systemic circulation and trigger chronic inflammation manifesting as gastrointestinal symptoms.[9]

A large-scale prospective cohort study conducted across 21 countries, including South-East Asian population, followed 116,087 adults for a median of 9.7 years and found that higher ultra-processed food consumption was significantly associated with increased risk of developing inflammatory bowel disease (hazard ratio 1.82, 95% confidence interval). The study identified specific ultra-processed food categories as particularly problematic, including soft drinks, refined sweetened foods, salty snacks and processed meat, all of which showed elevated hazard ratios for inflammatory bowel disease development.[10]

The association between UPF consumption and increased upper respiratory tract infections (p=0.028) reflects broader evidence linking UPF intake to compromised immune function through pro-inflammatory processes that extend beyond the gastrointestinal system.[11]

Similarly, behavioural irritability associated with higher UPF consumption (p=0.046) aligns with emerging research on the gut-brain axis and UPF-induced neuroinflammation, where gut microbiota disruption reduces production of neuroactive metabolites essential for proper brain development and emotional regulation.[12]

Our findings demonstrate a statistically significant inverse association between maternal dietary knowledge, attitudes and practices (KAP) scores and child ultra-processed food (UPF) consumption patterns, with this relationship consistently observed across both urban and rural demographic contexts ($p<0.05$). This cross-setting consistency underscores the pivotal role of caregiver's nutritional literacy in shaping dietary behaviours during early childhood period.

Certain limitations in the study design and methodology require consideration. The reliance on seven-day recall for UPF frequency assessment may introduce recall bias and does not capture portion sizes or nutrient composition. The cross-sectional design precludes establishing temporal relationships between maternal KAP, UPF consumption and health outcomes. Multi-site studies incorporating diverse geographic and cultural contexts would strengthen external validity.

The Food Safety and Standards Authority of India has begun implementing elements through the "Eat Right Movement," yet comprehensive measures including front-of-package warning labels and taxation on unhealthy processed foods are needed.[13] Future longitudinal research should explore causal pathways, incorporate objective biomarkers and evaluate the effectiveness of combined educational and policy interventions.[14]

CONCLUSION

Frequent ultra-processed food consumption is linked to greater prevalence of illness and health complaints in children aged 2 to 6 years. In this urban–rural study, lower maternal KAP scores were associated with significantly higher UPF intake in children aged 2 to 6 years. These findings reinforce the importance of empowering mothers with nutrition knowledge and practical skills to promote healthier food choices for young children.[15]

Public health strategies must integrate maternal nutrition education into existing community platforms such as Anganwadi centres while simultaneously addressing environmental drivers through regulatory measures and marketing restrictions. Reducing children's exposure to ultra-processed food represents a critical investment in their healthy future, requiring immediate action before the window of opportunity closes.

REFERENCES

1. Monteiro CA, Cannon G, Levy RB, et al. Ultra-processed foods: what they are and how to identify them. Public Health Nutr. 2019;22(5):936-941.
2. Baker P, Machado P, Santos T, Sievert K, Backholer K, Hadjikakou M, et al. Ultra- processed foods and the nutrition transition: global, regional and national trends, food systems transformations and political economy drivers. Obes Rev. 2020;21(12):e13126
3. Pandav CS, MacKinnon R, Vivek G, Anand K, Kardam A. The WHO South-East Asia Region Nutrient Profile Model is appropriate for India. Nutrients. 2021;13(8):2799
4. Popkin BM, Corvalan C, Grummer-Strawn LM. Dynamics of the double burden of malnutrition. Lancet. 2020;395(10217):65-74.
5. Kumar A, Kulchar RJ, Khadka N, et al. Maternal–child consumption of ultra-processed foods in Mumbai, India. J Health Popul Nutr. 2023;42(1):142.
6. Srour B, Fezeu LK, Kesse-Guyot E, Allès B, Méjean C, Andrianasolo RM, et al. Ultra-processed food intake and risk of cardiovascular disease: prospective cohort study (NutriNet-Santé). BMJ. 2019;365:l1451.
7. Brichacek AL, Florkowski M, Abiona E, Frank KM. Ultra-processed foods: impact on gut microbiome and metabolic health. Nutrients. 2024;16(11):1738.
8. Zinöcker MK, Lindseth IA. The Western diet-microbiome-host interaction and its role in metabolic disease. Nutrients. 2018;10(3):365.
9. Steele EM, Baraldi LG, Louzada ML, Moubarac JC, Mozaffarian D, Monteiro CA. Ultra-processed foods and added sugars in the US diet: evidence from a nationally representative cross-sectional study. BMJ Open. 2016;6(3):e009892.
10. Narula N, Wong ECL, Dehghan M, Mente A, Rangarajan S, Lanas F, et al. Association of ultra-processed food intake with risk of inflammatory bowel disease: prospective cohort study. BMJ. 2021;374:n1554.
11. Beslay M, Srour B, Méjean C, Allès B, Fiolet T, Debras C, et al. Ultra-processed food intake in association with BMI change and risk of overweight and obesity: a prospective analysis of the French NutriNet-Santé cohort. PLoS Med. 2020;17(8):e1003256.
12. Gómez-Donoso C, Sánchez-Villegas A, Martínez-González MA, Gea A, Mendonça RD, Lahortiga-Ramos F, et al. Ultra-processed food consumption and the incidence of depression in a Mediterranean cohort: the SUN Project. Eur J Nutr. 2020;59(3):1093-1103.
13. Food Safety and Standards Authority of India. Guidance Note: Restrictions on Advertisement of Foods High in Fat, Salt and Sugar [Internet]. New Delhi: FSSAI; 2022 [cited 2025 Sep 11]. Available from: https://www.fssai.gov.in/upload/uploadfiles/files/Compendium_Advertising_Claims_Regulations_14_12_2022.pdf
14. Khandpur N, Neri DA, Monteiro CA, Mazur A, Frelut ML, Boyland E, et al. Ultra-processed food consumption among the paediatric population: an overview and call to action from the European Childhood Obesity Group. Ann Nutr Metab. 2020;76(2):109-113.
15. World Health Organization. Report of the Commission on Ending Childhood Obesity [Internet]. Geneva: WHO; 2016 [cited 2025 Sep 11].