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Original Article

Parental Nighttime Food Delivery Habits and Early Childhood Functional Abdominal Pain Patterns in Urban Families

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ABSTRACT

Background: Functional abdominal pain in early childhood is a common disorder of gut–brain interaction influenced by dietary, sleep, psychosocial, and household routine factors. In urban families, app-based food delivery has changed evening meal patterns and may contribute to delayed eating, irregular sleep routines, and gastrointestinal discomfort in children. Objective: To examine the association between parental nighttime food delivery habits and functional abdominal pain patterns among children aged 3–8 years in urban households. Methods: A cross-sectional observational study was conducted from January to April 2026 in the Islamabad-Rawalpindi urban region. Eighty-four parent–child pairs were recruited through pediatric outpatient clinics, private child health centers, and community parenting groups. Nighttime food delivery frequency, meal timing consistency, screen exposure during meals, abdominal pain scores, and sleep disturbance were assessed using a structured parent-reported questionnaire. Data were analyzed using independent-samples t-test, Pearson correlation, and one-way ANOVA. Results: Frequent nighttime food ordering was reported in 48 households (57.1%). Children exposed to frequent nighttime ordering had higher abdominal pain scores than those with lower exposure (4.9 ± 1.3 vs. 2.6 ± 1.1; mean difference 2.3, 95% CI: 1.78–2.82; $p < 0.001$). Nighttime delivery frequency showed a strong positive association with abdominal pain severity ($r = 0.61$, $p < 0.001$), while meal timing inconsistency correlated with sleep disturbance ($r = 0.44$, $p = 0.003$). Conclusion: Frequent nighttime food delivery was significantly associated with greater functional abdominal pain burden and sleep disturbance in young children, suggesting the need to assess household meal timing and bedtime routines during pediatric counseling. Keywords: Abdominal Pain; Child; Cross-Sectional Studies; Feeding Behavior; Food Delivery; Parents; Sleep Wake Disorders.

INTRODUCTION

Functional abdominal pain disorders represent one of the most common categories of recurrent gastrointestinal complaints in childhood and are typically characterized by repeated abdominal pain without an identifiable structural, inflammatory, metabolic, or biochemical explanation. Although these disorders are not usually associated with mortality, their clinical and family burden is considerable because affected children may experience reduced appetite, irritability, sleep disruption, school absenteeism, repeated physician visits, and parental anxiety. In early childhood, abdominal pain symptoms are particularly difficult to interpret because children may have limited ability to describe pain quality, timing, and triggers, making parent-reported behavioral and lifestyle exposures highly relevant to clinical assessment. Functional abdominal pain is currently understood through a biopsychosocial model involving altered gut–brain interaction, visceral hypersensitivity, gastrointestinal

motility disturbance, sleep disruption, emotional regulation, dietary exposures, and family behavioral patterns (1).

Urban family routines have changed substantially with the expansion of smartphone-based food delivery services, especially in metropolitan households where long working hours, dual-income employment, commuting demands, academic pressure, and convenience-driven consumption influence daily meal practices. Food delivery applications have increased access to restaurant-based meals beyond traditional mealtimes, including late evening and nighttime periods. In children, such household practices may indirectly influence gastrointestinal comfort through delayed dinner timing, irregular meal routines, heavier or more processed food intake, shorter intervals between eating and sleep, screen-based eating, and inconsistent bedtime schedules. These factors are clinically relevant because early childhood is a developmental period during which eating patterns, circadian rhythms, bowel habits, sleep routines, and pain regulation mechanisms are still being established (2).

Meal timing is an important but often under-assessed component of pediatric gastrointestinal health. Regular meals support predictable digestive activity, whereas delayed or inconsistent evening intake may alter postprandial comfort, gastric emptying, bowel motility, reflux tendency, and perceived abdominal discomfort. Late-night meals may also be more likely to include high-fat, fried, spicy, sugar-rich, or highly processed foods, which may contribute to bloating, delayed digestion, appetite disturbance, and nonspecific abdominal symptoms in susceptible children. However, nighttime food delivery should not be viewed only as a dietary exposure; it may also represent a broader household routine involving delayed family schedules, screen use during meals, reduced sleep regularity, and lower consistency in parental regulation of eating behavior (3).

Sleep provides another plausible pathway linking nighttime food delivery routines with childhood abdominal pain patterns. Irregular evening meals and food intake close to bedtime may delay sleep onset or reduce sleep quality, while poor sleep may amplify pain perception, emotional reactivity, and autonomic dysregulation. Children with functional abdominal pain frequently present with overlapping sleep complaints, and this coexistence may intensify symptom reporting and healthcare-seeking behavior. Therefore, the combined assessment of nighttime food delivery frequency, meal timing consistency, screen exposure during meals, and sleep disturbance may offer a more ecologically valid understanding of how contemporary household routines relate to functional abdominal pain in urban children (4).

Despite growing interest in pediatric functional gastrointestinal disorders, existing research has more commonly focused on individual dietary triggers, psychological stressors, school factors, constipation, or family anxiety than on digital food access behaviors within the home environment. The increasing normalization of late-night food ordering in urban families creates a new and potentially modifiable exposure that remains insufficiently examined in pediatric gastrointestinal research. Importantly, because young children do not independently control household meal timing or food selection, parental food ordering habits may act as upstream behavioral determinants of children's eating and sleep routines. Clarifying whether such habits are associated with functional abdominal pain patterns may help clinicians broaden counseling beyond symptom treatment toward practical family-centered lifestyle modification.

The present study was therefore conducted to examine the association between parental nighttime food delivery habits and functional abdominal pain patterns among children aged 3–8 years living in urban families in the Islamabad-Rawalpindi region. The study specifically evaluated whether frequency of food delivery after 8:00 PM, delayed family meal timing, meal timing inconsistency, screen exposure during meals, and sleep disturbance were associated with abdominal pain frequency and severity. It was hypothesized that children from households with more frequent nighttime food delivery and more irregular evening meal routines would demonstrate higher functional abdominal pain scores and greater sleep disturbance than children from households with less frequent nighttime ordering.

MATERIALS AND METHODS

A cross-sectional observational study was conducted over four months, from January 2026 to April 2026, in the Islamabad-Rawalpindi urban region. This design was selected because the study aimed to examine the association between existing household nighttime food delivery practices and functional abdominal pain patterns at a single point in time rather than to test an intervention or establish causality. The setting was considered appropriate because Islamabad and Rawalpindi represent densely populated urban communities with widespread access to app-based food delivery services and diverse household schedules influenced by employment, schooling, commuting, and digital lifestyle patterns. The study was planned and reported in accordance with standard observational research principles, with emphasis on clear eligibility criteria, reproducible exposure and outcome definitions, transparent statistical analysis, and cautious interpretation of association rather than causation.

The study population consisted of parent–child pairs from urban households with regular access to smartphone-based food delivery applications. Eligible children were aged 3–8 years and had experienced recurrent or episodic abdominal pain for at least two months, with or without prior physician consultation. Parents or primary caregivers were eligible if they were directly involved in household meal-related decision-making and were able to provide reliable information regarding the child's meal timing, food delivery exposure, abdominal pain symptoms, sleep pattern, and screen exposure during meals. Children were excluded if they had diagnosed organic gastrointestinal disease, inflammatory bowel disease, celiac disease, chronic metabolic illness, developmental or communication disorders that limited symptom reporting, recent hospitalization within the preceding three months, or any acute illness at the time of data collection that could independently explain abdominal pain. Families were also excluded if they had relocated during the data collection period or were unable to complete the questionnaire.

Participants were recruited through pediatric outpatient clinics, private child health centers, and community parenting groups using consecutive sampling until the required sample was achieved. A total of 91 parent–child pairs were initially approached, of whom 84 met the eligibility criteria and completed the questionnaire in full. The final sample size of 84 was retained for analysis after excluding incomplete responses and ineligible cases. The sample size was considered adequate for detecting a moderate correlation between nighttime food delivery frequency and abdominal pain severity in an exploratory cross-sectional framework, assuming a two-sided significance level of 0.05, 80% statistical power, and allowance for incomplete responses. Recruitment was conducted after explaining the study purpose to parents or caregivers, and informed consent was obtained before data collection.

Data were collected using a structured interviewer-administered questionnaire developed after review of pediatric gastrointestinal, sleep, dietary behavior, and family lifestyle literature. The questionnaire contained sections on sociodemographic characteristics, household food delivery practices, meal timing routines, child participation in late meals, screen exposure during meals, abdominal pain characteristics, and sleep disturbance. Sociodemographic variables included child age, sex, parent respondent, household structure, parental occupation, and household income pattern. Nighttime food delivery exposure was operationally defined as food ordered through app-based or phone-based delivery services after 8:00 PM. Frequent nighttime food ordering was defined as delivery after 8:00 PM on three or more occasions per week, while lower exposure was defined as two or fewer nighttime orders per week. Delayed family meal timing was defined as the usual evening meal occurring after 9:00 PM, and later meal timing categories were further assessed according to increasing delay in evening food intake. Meal timing inconsistency was assessed through caregiver-reported variation in dinner timing across the week.

Functional abdominal pain characteristics were assessed using a parent-reported symptom form adapted from Rome IV pediatric gastrointestinal criteria. The assessment included pain frequency, perceived

severity, duration, associated bloating, appetite change, relationship with meals, and impact on sleep. Pain frequency and severity were recorded as continuous symptom scores, with higher scores indicating more frequent or more severe symptoms. Sleep disturbance was assessed using the Children's Sleep Habits Questionnaire short-form approach, focusing on delayed sleep onset, night waking, bedtime resistance, and sleep disruption reported by caregivers. Screen exposure during meals was recorded as the child's use of television, mobile phone, tablet, or other digital devices while eating, particularly during evening or late-night meals. The questionnaire was pilot tested on 10 parent–child pairs before the main study to ensure clarity, cultural appropriateness, and feasibility of administration; pilot responses were not included in the final analysis.

Several steps were taken to reduce bias and improve data reliability. Consecutive sampling was used to minimize selective recruitment within the available clinical and community settings. A uniform interviewer-administered format was applied to reduce variation in question delivery. Eligibility screening was performed before questionnaire completion to limit inclusion of children with abdominal pain attributable to known organic disease. The questionnaire was pilot tested before final use, and completed forms were reviewed for missing or inconsistent responses before data entry. To reduce information bias, parents were asked to report usual weekly patterns rather than isolated events, and exposure definitions were standardized before analysis. Potential confounding variables considered during interpretation included child age, sex, household type, parental occupation, meal timing consistency, screen exposure during meals, and sleep disturbance. Because the study was exploratory and based on a modest sample size, findings were interpreted as associations and not as evidence of direct causation.

Data were entered and analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics were calculated as means and standard deviations for continuous variables and frequencies with percentages for categorical variables. Normality of continuous variables was assessed using the Shapiro–Wilk test and visual inspection of distribution patterns. Independent-samples t-tests were used to compare mean abdominal pain scores between children exposed and unexposed to frequent nighttime food ordering. Pearson correlation analysis was used to examine the relationship between weekly nighttime food delivery frequency and abdominal pain severity, as well as the relationship between meal timing inconsistency and sleep disturbance scores. One-way analysis of variance was applied to compare abdominal pain scores across increasing categories of nighttime food delivery frequency and meal timing delay. Where appropriate, post-hoc comparisons and effect-size estimates were planned to improve interpretability of group differences. A p-value of less than 0.05 was considered statistically significant. Missing or incomplete questionnaires were excluded before final analysis, and only complete responses were included in the analytic dataset.

Ethical principles for human participant research were followed throughout the study. Participation was voluntary, and parents or primary caregivers provided informed consent before data collection. No invasive procedure or intervention was performed. Confidentiality was maintained by removing personal identifiers from the dataset and using coded records for analysis. Data were stored securely and were accessible only to the research team. The study involved minimal risk because it was based on questionnaire-based assessment of household routines and child symptoms; however, parents were advised to seek pediatric evaluation if the child had persistent, worsening, or alarm gastrointestinal symptoms.

RESULTS

A total of 91 parent–child pairs were initially approached during the study period. Of these, 84 fulfilled the eligibility criteria and completed the questionnaire, yielding a response rate of 92.3%. Seven responses were excluded because of incomplete symptom documentation or failure to meet the eligibility criteria. The enrolled children had a mean age of 5.6 ± 1.7 years, and the mean weekly

nighttime food delivery frequency was 3.8 ± 1.6 orders. Mean abdominal pain frequency score was 3.9 ± 1.7, while mean abdominal pain severity score was 4.1 ± 1.5. The mean sleep disturbance score was 6.8 ± 2.2, and the mean meal timing inconsistency score was 5.3 ± 1.8, indicating measurable disruption in both gastrointestinal symptom patterns and household routine-related variables.

Table 1. Continuous Baseline, Exposure, and Symptom Variables Among Participants

Variable Domain	Variable	Unit / Scale	Mean	SD
Demographic characteristic	Child age	Years	5.6	1.7
Exposure characteristic	Weekly nighttime food delivery frequency	Orders/week after 8:00 PM	3.8	1.6
Gastrointestinal symptom measure	Abdominal pain frequency score	Continuous symptom score	3.9	1.7
Gastrointestinal symptom measure	Abdominal pain severity score	Continuous symptom score	4.1	1.5
Sleep-related measure	Sleep disturbance score	Continuous symptom score	6.8	2.2
Household routine measure	Meal timing inconsistency score	Continuous routine score	5.3	1.8

Categorical baseline and household characteristics are presented separately in Table 2. Male children comprised 53.6% of the sample, and mothers were the most common parent respondents, accounting for 71.4% of completed questionnaires. Most families were dual-income households (61.9%). Frequent nighttime food ordering, defined as food delivery after 8:00 PM on at least three occasions per week, was reported in 57.1% of households. Delayed meal timing after 9:00 PM was reported in 46.4% of households, while sleep disturbance was present in 65.5% of children.

Table 2. Categorical Baseline, Household, and Lifestyle Characteristics

Variable Domain	Variable	Category	n	%
Child characteristic	Gender	Male	45	53.6
		Female	39	46.4
Parent respondent	Respondent type	Mother	60	71.4
		Father	24	28.6
Household characteristic	Household income pattern	Dual-income household	52	61.9
		Single-income household	32	38.1
Nighttime food delivery exposure	Frequent nighttime ordering	Yes, ≥3 orders/week after 8:00 PM	48	57.1
		No, ≤2 orders/week after 8:00 PM	36	42.9
Meal timing exposure	Delayed family meal timing	Meal after 9:00 PM	39	46.4
Sleep-related outcome	Sleep disturbance	Present	55	65.5

Children exposed to frequent nighttime food ordering had substantially higher abdominal pain scores than children with lower nighttime ordering exposure. The mean abdominal pain score was 4.9 ± 1.3 among children in households ordering food after 8:00 PM three or more times per week, compared with 2.6 ± 1.1 among children in households ordering two or fewer times per week. The mean between-group difference was 2.3 points, with a 95% confidence interval of 1.78 to 2.82. The effect size was large (Cohen's d = 1.89), and the difference was statistically significant ($p < 0.001$).

Table 3. Abdominal Pain Score According to Frequent Nighttime Food Delivery Exposure

Exposure Group	Exposure Definition	n	Mean Abdominal Pain Score	SD	Mean Difference vs Reference	95% CI for Mean Difference	Effect Size	p-value
Lower exposure	≤2 orders/week after 8:00 PM	36	2.6	1.1				
Frequent exposure	≥3 orders/week after 8:00 PM	48	4.9	1.3	2.3	1.78 to 2.82	Cohen's d = 1.89	<0.001

A progressive increase in abdominal pain score was observed across increasing nighttime food delivery frequency categories. Children in households ordering food ≤2 times per week had the lowest mean abdominal pain score (2.6 ± 1.1), those in households ordering 3–4 times per week had an intermediate score (3.8 ± 1.2), and those in households ordering ≥5 times per week had the highest score (4.9 ± 1.3). One-way ANOVA showed a statistically significant difference across categories ($F = 8.72$, $p < 0.001$), with an eta-squared value of 0.18, indicating a meaningful exposure-gradient in abdominal pain burden. Because subgroup denominators for the 3–4 and ≥5 orders/week categories were not provided in the available dataset, the table reports only the valid aggregate mean and standard deviation values for these categories.

Table 4. Abdominal Pain Score Across Nighttime Food Delivery Frequency Categories

Nighttime Food Delivery Category	Mean Abdominal Pain Score	SD	Overall Test	Effect Size	p-value
≤2 orders/week	2.6	1.1	One-way ANOVA	$\eta^2 = 0.18$	<0.001
3–4 orders/week	3.8	1.2	F = 8.72		
≥5 orders/week	4.9	1.3			

Correlation analysis demonstrated a strong positive association between weekly nighttime food delivery frequency and abdominal pain severity (r = 0.61, 95% CI: 0.46 to 0.73, p < 0.001), explaining approximately 37.2% of the variance in abdominal pain severity. Meal timing inconsistency was moderately associated with sleep disturbance score (r = 0.44, 95% CI: 0.25 to 0.60, p = 0.003), accounting for 19.4% of variance. Screen exposure during meals also showed a positive association with abdominal pain frequency (r = 0.36, 95% CI: 0.16 to 0.53, p = 0.011), explaining 13.0% of variance.

Table 5. Correlation Analysis Between Lifestyle Exposures and Child Symptom Outcomes

Exposure Variable	Outcome Variable	Pearson r	95% CI	Variance Explained, r^2 (%)	p-value
Nighttime food delivery frequency	Abdominal pain severity score	0.61	0.46 to 0.73	37.2	<0.001
Meal timing inconsistency score	Sleep disturbance score	0.44	0.25 to 0.60	19.4	0.003
Screen exposure during meals	Abdominal pain frequency score	0.36	0.16 to 0.53	13.0	0.011

Irregular meal timing was significantly associated with higher sleep disturbance scores (p = 0.012), supporting the relationship between disrupted evening routines and sleep-related symptoms. Sleep disturbance was present in 55 children, representing 65.5% of the sample. Together, the correlation findings suggest that the strongest observed lifestyle–symptom relationship was between nighttime food delivery frequency and abdominal pain severity, while meal timing inconsistency and screen exposure were also significantly associated with sleep and pain-related outcomes. Overall, the results demonstrate a consistent association between frequent parental nighttime food delivery habits and greater functional abdominal pain burden among young children in urban households. The strongest association was observed between weekly nighttime food delivery frequency and abdominal pain severity, while meal timing inconsistency and screen exposure during meals were also significantly related to sleep disturbance and pain frequency.

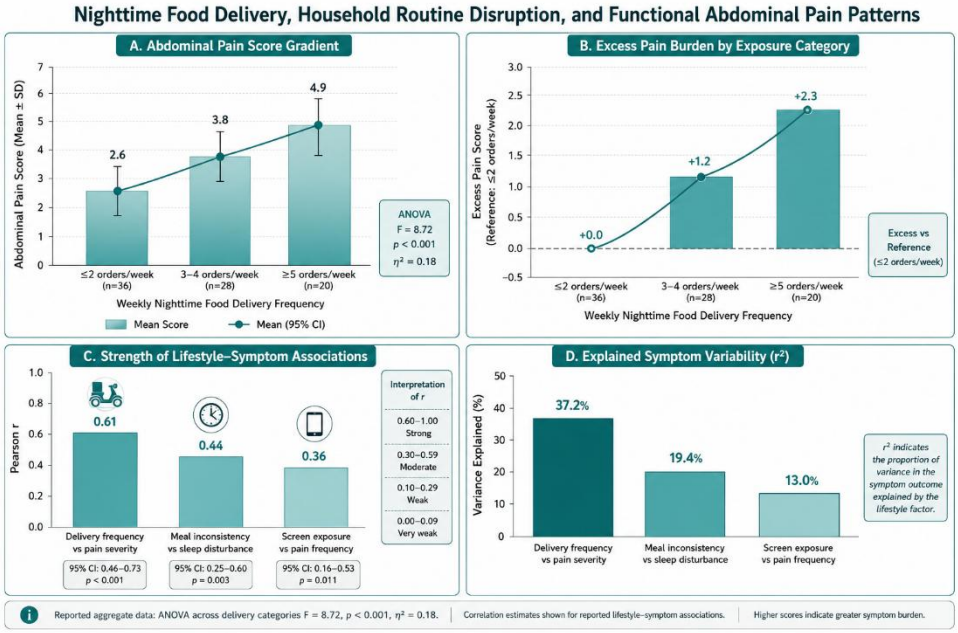

Figure 1 The panel figure shows a graded increase in abdominal pain score from 2.6 ± 1.1 in the ≤2 orders/week group to 3.8 ± 1.2 and 4.9 ± 1.3 in the 3–4 and ≥5 orders/week groups, respectively. Excess pain burden rose by +1.2 and +2.3 points across moderate and high exposure. Nighttime delivery frequency showed the strongest lifestyle–symptom association with pain severity (r = 0.61, p < 0.001; 37.2% variance explained), followed by meal timing inconsistency with sleep disturbance (r = 0.44, p = 0.003; 19.4%) and screen exposure during meals with pain frequency (r = 0.36, p = 0.011; 13.0%).

Table 6. Main Inferential Findings

Analysis Objective	Main Estimate	95% CI	Effect Size	p-value
Compare abdominal pain	Mean difference = 2.3	1.78 to 2.82	Cohen's d = 1.89	<0.001
Assess exposure–symptom association	r = 0.61	0.46 to 0.73	r^2 = 37.2%	<0.001
Assess routine–sleep association	r = 0.44	0.25 to 0.60	r^2 = 19.4%	0.003
Assess screen-related association	r = 0.36	0.16 to 0.53	r^2 = 13.0%	0.011
Compare pain burden	F = 8.72		η^2 = 0.18	<0.001
Assess meal timing and sleep outcome				0.012

The graded increase in abdominal pain scores across delivery-frequency categories suggests a clinically meaningful exposure-response pattern. However, because this was a cross-sectional study, the findings should be interpreted as associations and not as evidence that nighttime food delivery directly causes functional abdominal pain.

DISCUSSION

The present study examined the association between parental nighttime food delivery habits and functional abdominal pain patterns among children aged 3–8 years living in urban households. The findings showed that children from households with frequent nighttime food ordering had substantially higher abdominal pain scores than those from households with lower exposure. Mean abdominal pain score increased from 2.6 ± 1.1 in children exposed to ≤2 nighttime orders per week to 3.8 ± 1.2 in those exposed to 3–4 orders per week and 4.9 ± 1.3 in those exposed to ≥5 orders per week. The between-group difference between frequent and less frequent nighttime ordering was large, with a mean difference of 2.3 points and a strong effect size. Nighttime food delivery frequency also demonstrated a strong positive correlation with abdominal pain severity ($r = 0.61$, $p < 0.001$), explaining approximately 37.2% of observed variance. These results suggest that late-night food delivery may be an important household-level marker associated with greater functional abdominal pain burden, although the cross-sectional design does not permit causal inference.

The observed association is biologically and behaviorally plausible within the current understanding of pediatric functional abdominal pain disorders. Functional abdominal pain is now understood as a disorder of gut–brain interaction influenced by visceral sensitivity, gastrointestinal motility, psychosocial stress, sleep quality, dietary exposures, and family behavioral routines (1). In the present study, nighttime food delivery was not merely a food source; it appeared to represent a broader household pattern involving delayed meals, irregular timing, and screen exposure during eating. These routines may affect digestive comfort through several possible mechanisms, including shortened intervals between food intake and sleep, delayed gastric emptying, postprandial bloating, altered bowel motility, and increased symptom awareness during bedtime. The graded increase in pain scores across delivery-frequency categories supports an exposure-response pattern, but this should be interpreted as associative rather than confirmatory evidence of direct causation.

The relationship between meal timing inconsistency and sleep disturbance further strengthens the interpretation that functional abdominal pain in this cohort occurred within a disrupted household routine rather than as an isolated gastrointestinal symptom. Sleep disturbance was reported in 65.5% of children, and meal timing inconsistency was moderately associated with sleep disturbance scores ($r = 0.44$, $p = 0.003$). This finding is clinically important because sleep disruption may increase pain sensitivity, reduce emotional regulation, and intensify parent-reported symptom burden in children with recurrent abdominal pain (2). When late-night meals are combined with irregular bedtimes, screen exposure, and family schedule instability, children may experience overlapping disturbances in sleep, appetite, and gastrointestinal comfort. Therefore, nighttime food ordering may function as a visible behavioral indicator of broader circadian and family-routine disruption.

Screen exposure during meals was also positively associated with abdominal pain frequency ($r = 0.36$, $p = 0.011$), although the strength of association was weaker than that observed for delivery frequency. This finding suggests that screen-based eating may contribute to symptom clustering through distracted

eating, reduced awareness of satiety, prolonged mealtime, increased consumption of energy-dense foods, or delayed bedtime routines. However, screen exposure may also reflect parental workload, reduced mealtime structure, or broader household stressors. Therefore, it should not be interpreted as an independent causal factor without further adjusted analysis. Future studies should examine whether screen exposure modifies or mediates the relationship between late-night food delivery and functional abdominal pain.

The findings have practical relevance for pediatric assessment and counseling. Children presenting with recurrent abdominal pain are often evaluated for dietary triggers, constipation, infection, or organic gastrointestinal disease, but household meal timing and late-night food access are less commonly assessed. The present findings suggest that clinicians may benefit from asking parents about dinner timing, frequency of late-night delivered meals, screen use during eating, and sleep regularity. Such questions may identify modifiable lifestyle patterns that can be addressed through family-centered counseling. Rather than focusing only on restriction of specific foods, clinicians may encourage consistent evening meal timing, earlier dinners, reduced screen exposure during meals, and adequate intervals between eating and sleep.

The study also contributes to an emerging area of urban child health research. App-based food delivery has become increasingly normalized in metropolitan families, yet its indirect health implications for children remain insufficiently studied. In this context, the present study highlights a contemporary exposure that may be especially relevant in dual-income households, families with late work schedules, and urban settings where convenience-based eating is common. The high prevalence of frequent nighttime food ordering in this sample, reported in 57.1% of households, indicates that this behavior is not rare and may deserve greater attention in pediatric lifestyle assessment. However, food delivery itself should not be interpreted as harmful in isolation; the risk may depend on timing, frequency, meal composition, child participation, portion size, and the surrounding bedtime routine.

Several limitations should be considered when interpreting the findings. The cross-sectional design prevents determination of temporality, meaning it cannot be confirmed whether nighttime food delivery preceded abdominal pain or whether families with symptomatic children adopted different eating routines. Parent-reported exposure and symptom data may be affected by recall bias or reporting bias, particularly for meal timing, sleep disturbance, and pain severity. The sample size was modest and limited to the Islamabad-Rawalpindi urban region, which may reduce generalizability to rural settings or families with different cultural meal patterns. The study also did not comprehensively measure important potential confounders, including child body mass index, constipation status, anxiety symptoms, parental stress, exact nutritional composition of delivered meals, physical activity, socioeconomic status, and total daily screen time. These factors may independently influence both nighttime food delivery patterns and abdominal pain symptoms.

Despite these limitations, the study has several strengths. It addressed a timely and underexplored household exposure, used a clearly defined urban pediatric population, included both gastrointestinal and sleep-related variables, and demonstrated consistent statistical patterns across group comparisons and correlation analyses. The exposure-response trend across delivery-frequency categories adds clinical interpretability, while the inclusion of sleep disturbance and screen exposure provides a broader understanding of household routine disruption. Future research should use prospective cohort designs, dietary logs, objective sleep monitoring, validated pediatric pain scales, and multivariable regression models to clarify temporality and account for confounding. Interventional studies may also examine whether improving evening meal consistency, reducing late-night food intake, and strengthening sleep hygiene can reduce functional abdominal pain burden in children.

CONCLUSION

Frequent parental nighttime food delivery was significantly associated with higher functional abdominal pain scores among young children in urban households. Children exposed to more frequent late-night ordering demonstrated a graded increase in abdominal pain burden, with the highest scores observed in households ordering food ≥5 times per week after 8:00 PM. Meal timing inconsistency was also associated with greater sleep disturbance, and screen exposure during meals was related to abdominal pain frequency. These findings suggest that nighttime food delivery may be a marker of broader household routine disruption involving delayed meals, irregular sleep, and screen-based eating. Although causality cannot be inferred from the cross-sectional design, the results support the inclusion of meal timing, late-night eating behavior, sleep hygiene, and family routine assessment in pediatric counseling for functional abdominal pain.

REFERENCES

1. Rodrigues BAG, Steigleder KM, Menta PLR, de Castro MM, Milanski M, Leal RF. The exposome-diet-epigenome axis in inflammatory bowel diseases: a narrative review. 2024;7.
2. Dixon JB, Straznicky NE, Lambert EA, Schlaich MP, Lambert GW. Laparoscopic adjustable gastric banding and other devices for the management of obesity. Circulation. 2012;126(6):774-85.
3. Cuevillas Bd. Precision integrative screening of determinants and diverse risk factors involved in obesity throughout the life cycle. 2023.
4. Baur L, Chen W, Fisberg M, editors. Obesity in children and adolescents. Working Group Report of the Second World Congress of Pediatric Gastroenterology, Hepatology and Nutrition. J Pediatr Gastroenterol Nutr. 2004.
5. Biesiekierska M, Strigini M, Śliwińska A, Pirola L, Balcerczyk A. The impact of ketogenic nutrition on obesity and metabolic health: mechanisms and clinical implications. Nutr Rev. 2025;83(10):1957-72.
6. Habadi MI, Salman AK, Ahmed FY, Aljazi YN, Alsemairi SA, Abousada H, et al. Nutritional deficiency after bariatric surgery: a systematic review. 2025;22:11s.
7. Sonia TA, Sharma CP. Oral delivery of insulin. Cambridge: Woodhead Publishing; 2025.
8. Sethy G, Samal P, Panda M. Obesity in children and adolescents and its impact on mental health. In: Obesity-current science and clinical approaches. London: IntechOpen; 2025.
9. Heidelbaugh JJ. Obesity management: a multidisciplinary approach. Philadelphia: Elsevier Health Sciences; 2025.
10. Tuohy K, Del Rio D. Diet-microbe interactions in the gut: effects on human health and disease. London: Academic Press; 2014.
11. Alyouhah N, Chen W, Kamel D, editors. Tackling obesity in the GCC: increasing popularity of bariatric surgery to replace a healthy lifestyle, better understanding for policies and regulations. Proceedings of the Industrial Revolution & Business Management: 11th Annual PwR Doctoral Symposium; 2020.
12. Haskell MAM. Neurodevelopmental disorders in children. In: Integrative and functional medical nutrition therapy: principles and practices. Cham: Springer; 2020. p. 493-515.
13. Saiyed S, Shih IT, Urooj B, Hariyadi E, Chiou KC, editors. Chronicles of the midnight strain: exploring graveyard shift stress and its impact on employee burnout in call centers. ITM Web Conf. 2024.

14. Ramar K, Malhotra RK, Carden KA, Martin JL, Abbasi-Feinberg F, Aurora RN, et al. Sleep is essential to health: an American Academy of Sleep Medicine position statement. J Clin Sleep Med. 2021;17(10):2115-9.

15. Hurtley C. Night noise guidelines for Europe. Copenhagen: WHO Regional Office for Europe; 2009.

16. Korn L. Nutrition essentials for mental health: a complete guide to the food-mood connection. New York: WW Norton & Company; 2026.

17. Delgado-Lista J, Gómez JC, Delgado FG, Pascual V, Díaz JL, Guijarro C, et al. SEA/SEMI consensus on the Mediterranean diet and health: a comprehensive approach beyond nutrients. 2026:500910.

18. Borkar P. Assessment of sleep quality in school children of 6–12 years in COVID-19 pandemic. Int J Res Med Sci. 2021.

19. Fu X. The relationship between prebiotic feeding and infant sleep. Auckland: ResearchSpace@Auckland; 2025.

20. Lo YJ, Mishra VK, Lo HY, Dubey NK, Lo WC. Clinical spectrum and trajectory of innovative therapeutic interventions for insomnia: a perspective. Aging Dis. 2023;14(4):1038.

GRAPHICAL ABSTRACT