JHWCR

Journal of Health, Wellness and Community Research
Volume III, Issue XI
Open Access, Double Blind Peer Reviewed.
Web: https://jhwcr.com, ISSN: 3007-0570
https://doi.org/10.61919/7hs9hs56

Original Article

A Cross-Sectional Study on NPO Status and Its Fluctuation Rate in Pediatric Patients Undergoing Elective Surgeries: A Survey Based on Interviews

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Authors' Contributions: Concept: NUA; Design: MM; Data Collection: MAA; Analysis: HS; Drafting: SS
Cite this Article | Received: 2025-05-11 | Accepted 2025-08-07
No conflicts declared; ethics approved; consent obtained; data available on request; no funding received.

ABSTRACT

Background: Prolonged preoperative fasting in pediatric patients can cause hypoglycemia, dehydration, and increased perioperative stress, yet adherence to evidence-based nil per os (NPO) guidelines remains inconsistent. International recommendations advocate fasting durations tailored to intake type—2 hours for clear fluids, 4 hours for breast milk, 6 hours for light meals, and 8 hours for solids or high-fat meals—however, many institutions continue outdated, conservative practices. Objective: To evaluate adherence to ASA-recommended fasting durations among pediatric surgical patients, quantify deviations, and assess their distribution across age groups. Methods: A descriptive cross-sectional study was conducted at Mayo Hospital, Lahore, involving 210 pediatric patients aged 6 months–12 years undergoing elective surgery under general anesthesia. Participants were selected via simple random sampling. Data on intake type, prescribed fasting duration, and actual fasting time were collected via structured caregiver interviews. Statistical analysis used chi-square and descriptive measures in SPSS v26. Results: Only 8.6% of patients achieved exact adherence to guidelines, while 91.4% exhibited deviations, most commonly 2–3 hours longer than recommended. No significant association was found between age group and deviation (p=0.699). Conclusion: Excessive fasting is widespread across all pediatric age groups, indicating a need for updated institutional policies, improved scheduling, and caregiver education to align practice with evidence-based NPO guidelines.

Keywords: preoperative fasting, NPO, pediatric anesthesia, guideline adherence, fasting deviation.

INTRODUCTION

Preoperative fasting, or nil per os (NPO), is a critical component of pediatric perioperative care aimed at reducing the risk of pulmonary aspiration of gastric contents during anesthesia (1). Standardized guidelines, such as those issued by the American Society of Anesthesiologists (ASA), recommend fasting durations tailored to the type of intake—clear fluids up to two hours, breast milk up to four hours, infant formula or light meals up to six hours, and solid or high-fat meals up to eight hours prior to anesthesia induction (2). These recommendations, grounded in evidence from multiple clinical studies and meta-analyses, are designed to balance patient safety with metabolic stability (3). Despite this, adherence in clinical practice, particularly in pediatric settings, remains inconsistent, often deviating towards unnecessarily prolonged fasting (4). Prolonged fasting in children can precipitate dehydration, hypoglycemia, electrolyte imbalances, irritability, and increased perioperative stress, with younger children being particularly vulnerable due to higher metabolic rates and lower glycogen reserves (5,6).

The problem is exacerbated in low- and middle-income countries, where institutional inertia, outdated fasting protocols, surgical scheduling delays, and miscommunication between healthcare providers and caregivers contribute to non-compliance with evidence-based guidelines (7,8). Studies from tertiary pediatric centers report NPO violation rates ranging from 3.5% to over 16%, with deviations in either direction—shorter fasting increasing aspiration risk or longer fasting prolonging physiological stress (9,10). Despite international consensus advocating liberalized fasting policies, many hospitals still enforce "NPO after midnight" rules without consideration of surgical timing, further widening the gap between best practice and reality (11). This gap is especially pronounced in South Asia, where formal audits of fasting practices are scarce, and no large-scale, pediatric-specific data exist from Pakistan to guide targeted interventions.

In this context, pediatric patients undergoing elective surgeries at tertiary care institutions face a dual challenge—avoiding aspiration while minimizing the harm of excessive fasting. The current study addresses a clear knowledge gap by systematically evaluating adherence to ASA fasting guidelines in a pediatric population, quantifying fluctuations in NPO duration, and assessing their physiological and procedural implications. By investigating fasting patterns across distinct age groups, the study aims to identify modifiable causes of

deviation and propose context-appropriate strategies to optimize perioperative care in children. The primary objective is to determine the prevalence and magnitude of deviations from recommended NPO durations among pediatric patients undergoing elective surgery, and to explore the association between these deviations and patient related as well as institutional factors.

MATERIAL AND METHODS

This study employed a descriptive cross-sectional design to assess adherence to preoperative fasting (NPO) guidelines and quantify deviations in fasting duration among pediatric patients scheduled for elective surgeries under general anesthesia at Mayo Hospital, Lahore. The design was chosen for its suitability in capturing a snapshot of current fasting practices and their variability without manipulating study variables, allowing for estimation of prevalence and exploration of associated factors in real-world clinical settings (12). The study was conducted in the Department of Anesthesia at King Edward Medical University–Mayo Hospital over the defined research period, encompassing scheduled elective surgical lists during routine hospital operation days.

Participants were pediatric patients aged between six months and twelve years who were scheduled for elective surgical procedures requiring general anesthesia or sedation. Eligible participants were identified through preoperative surgical rosters and recruited using a simple random sampling approach from the eligible pool to ensure representative distribution across age categories. Inclusion criteria encompassed patients with ASA physical status I or II undergoing elective procedures under general anesthesia or sedation. Exclusion criteria included emergency surgeries, patients admitted to intensive care units, those receiving local or regional anesthesia only, and individuals with incomplete fasting history data. Written informed consent was obtained from parents or legal guardians prior to participation, and all procedures were conducted in compliance with the Declaration of Helsinki (13).

Data collection took place in the preoperative wards on the day of surgery, prior to anesthesia induction. Trained research personnel conducted structured, face-to-face interviews with parents or guardians using a standardized data collection proforma. The instrument recorded patient demographics (age, sex), type of surgical procedure, last oral intake type and timing, prescribed NPO duration, actual fasting duration, and reasons for any deviation from recommendations. Fasting deviations were defined as differences between actual and guideline-recommended durations, expressed in hours above or below the target. Interviews incorporated both closed and open-ended questions to capture both quantitative fasting duration data and qualitative explanations for deviations.

Variables were operationally defined according to ASA guidelines (2). Fasting duration was calculated from the reported time of last oral intake to the documented time of anesthesia induction. Deviations were categorized in integer hours relative to the prescribed duration based on intake type. The primary outcome measure was the proportion of patients whose fasting duration deviated from recommended guidelines.

Secondary measures included distribution of deviations by age group, magnitude of excess fasting, and reasons for noncompliance. To address potential biases, standardized training was provided to data collectors to minimize interviewer variability, and all interviews were conducted in the caregivers' preferred language to reduce miscommunication bias. Random sampling reduced selection bias, while immediate preoperative data collection minimized recall bias. Data completeness was checked on site, and double data entry was implemented to ensure accuracy.

Sample size determination used a standard formula for estimating proportions in a finite population with a 95% confidence level, 5% margin of error, and an anticipated prevalence of fasting deviations informed by previous literature (9,10). Based on a hospital surgical register population of 460 eligible patients during the study period, the calculated sample size was 210 participants, ensuring adequate statistical power to detect meaningful differences across age strata (14). Data analysis was performed using IBM SPSS Statistics for Windows, version 26. Descriptive statistics summarized continuous variables as means with standard deviations or medians with interquartile ranges, and categorical variables as frequencies and percentages.

Associations between categorical variables, such as age group and fasting deviation category, were examined using the chi-square test. For comparisons of mean fasting durations, one-way analysis of variance (ANOVA) was applied where normality assumptions were met. Missing data were handled using complete case analysis, with no imputation performed. All statistical tests were two-tailed, with p-values <0.05 considered statistically significant.

Ethical approval was obtained from the Institutional Review Board of King Edward Medical University prior to study initiation. Confidentiality of patient information was ensured by assigning anonymized identification codes, and data were stored securely in password-protected files accessible only to the research team. Study conduct adhered to recognized ethical and methodological standards for pediatric anesthesia research to ensure reproducibility and integrity of findings (15).

RESULTS

A total of 210 pediatric patients were included in the analysis, with ages ranging from six months to twelve years. The largest proportion belonged to the 4–8 year group, comprising 53.8% (95% CI 46.9–60.5) of the sample, followed by children aged 6 months–3 years at

29.0% (95% CI 23.1–35.7) and those aged 9–12 years at 17.1% (95% CI 12.4–22.7). The cohort demonstrated a male predominance, with 61.0% (95% CI 54.1–67.5) boys scheduled for surgery compared to 39.0% (95% CI 32.5–45.9) girls. When adherence to ASA recommended fasting durations was examined by intake type, the majority of children (78.1%, 95% CI 71.9–83.3) met the 8-hour guideline for solids and high-fat meals, reflecting persistence of conservative fasting practices. However, only 20.0% (95% CI 15.0–26.1) complied with the 6-hour recommendation for infant formula or light meals, and a mere 1.9% (95% CI 0.5–4.8) adhered to the 4-hour window for breast milk, indicating substantial overuse of prolonged fasting periods in younger age groups.

Table 1. Demographic characteristics of pediatric patients undergoing elective surgeries (n = 210)

Characteristic	Frequency (n)	Percentage (%)	95% CI for %
Age Group			
6 months – 3 years	61	29.0	23.1–35.7
4 – 8 years	113	53.8	46.9–60.5
9 – 12 years	36	17.1	12.4–22.7
Sex			
Male	128	61.0	54.1–67.5
Female	82	39.0	32.5–45.9

Table 2. Adherence to ASA-recommended fasting durations by intake type

Recommended Intake Type (hrs)	Duration	Adherence (n)	Adherence (%)	95% CI for %
Breast milk	4	4	1.9	0.5–4.8
Infant formula / non-human milk / light meal	6	42	20.0	15.0–26.1
Solid food / high-fat meals	8	164	78.1	71.9–83.3

Table 3. Magnitude of deviations from recommended NPO durations

Deviation Category	Frequency (n)	Percentage (%)	95% CI for %
1 hour less	6	2.9	1.1–6.2
1 hour more	38	18.1	13.2–24.0
2 hours less	2	1.0	0.1–3.5
2 hours more	43	20.5	15.3–26.7
3 hours more	44	21.0	15.8–27.2
4 hours more	33	15.7	11.1–21.3
5 hours more	15	7.1	4.0–11.5
6 hours more	6	2.9	1.1–6.2
7 hours more	2	1.0	0.1–3.5
8 hours more	1	0.5	0.01–2.6
No fluctuation	18	8.6	5.1–13.2

Table 4. Association between age groups and fasting duration deviations

Age Group	Mean Deviation (hrs) ± SD	No Fluctuation n (%)	Fluctuation n (%)	p-value*
6 months – 3 years	2.75 ± 1.4	5 (8.2)	56 (91.8)	
4 – 8 years	2.85 ± 1.6	8 (7.1)	105 (92.9)	0.699
9 – 12 years	2.44 ± 1.3	5 (13.9)	31 (86.1)	

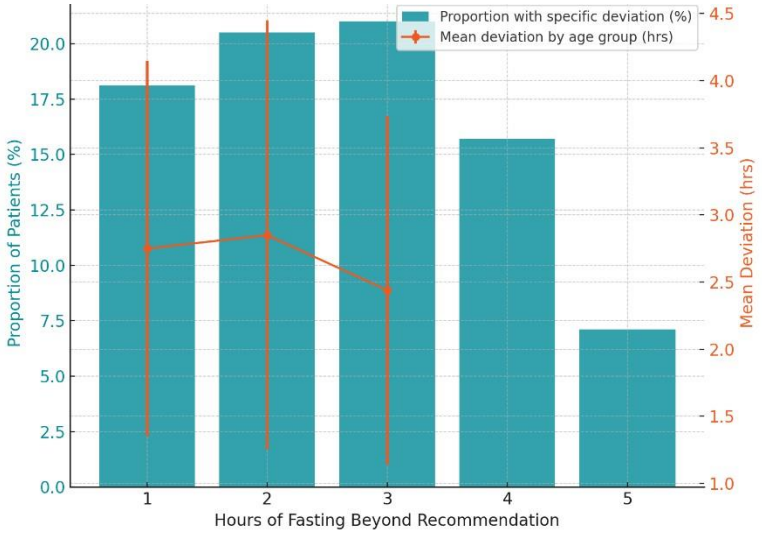

Figure 1 Fasting Deviations in Pediatric Elective Surgeries

Analysis of fasting deviations revealed that 91.4% of patients experienced departures from recommended durations, with only 8.6% (95% CI 5.1–13.2) achieving exact compliance. The most common excess was a 3-hour prolongation, observed in 21.0% (95% CI 15.8–27.2) of cases, followed closely by 2-hour extensions in 20.5% (95% CI 15.3–26.7) and 4-hour extensions in 15.7% (95% CI 11.1–21.3). Smaller but notable proportions fasted 5–8 hours longer than necessary, with 7.1% extending by 5 hours and a small number (≤1%) exceeding by 6–8 hours. Shortened fasting durations were rare, affecting fewer than 5% of patients, and typically limited to 1–2 hours less than recommended. When stratified by age group, mean deviation from target fasting times was similar—2.75 ± 1.4 hours in children aged 6 months–3 years,

2.85 ± 1.6 hours in those aged 4–8 years, and 2.44 ± 1.3 hours in the 9–12 year group. Chi-square analysis demonstrated no statistically significant association between age category and presence of deviation ($p = 0.699$), confirming that excessive fasting was a pervasive issue across all pediatric subgroups rather than being restricted to a particular developmental stage. Clinically, these findings underscore a systemic tendency toward prolonged fasting irrespective of patient age, with a particularly marked gap in adherence to shorter-duration recommendations for breast milk and light meals. Such deviations carry implications for hydration status, metabolic stability, and perioperative comfort, warranting targeted interventions to align practice with evidence-based guidelines.

The dual-axis visualization highlights that while 2–3-hour prolongations were the most frequent deviations—affecting 20.5% and 21.0% of patients respectively—mean deviation remained consistent across age groups, ranging from 2.44 to 2.85 hours. The error bars indicate overlapping variability between age strata, supporting the statistical finding of no significant age–deviation association ($p = 0.699$), and reinforcing that prolonged fasting is a widespread, system-level issue.

DISCUSSION

The present study provides a comprehensive evaluation of adherence to established preoperative fasting (NPO) guidelines among pediatric patients undergoing elective surgeries and quantifies the extent and nature of deviations from recommended durations. The finding that 91.4% of children experienced fasting durations outside the recommended limits, with only 8.6% demonstrating exact compliance, underscores a substantial gap between evidence-based guidelines and clinical practice. Although the American Society of Anesthesiologists (ASA) and other international bodies advocate fasting durations of two hours for clear fluids, four hours for breast milk, and six hours for infant formula or light meals to optimize perioperative safety and comfort (2), the persistence of extended fasting times—most commonly 2–3 hours longer than required—indicates that traditional, conservative fasting approaches remain entrenched in routine pediatric anesthesia practice (16).

These results align with reports from tertiary pediatric centers worldwide, where studies have demonstrated that prolonged fasting is not only common but also frequently unrelated to aspiration risk reduction. For example, Friedrich et al. (2020) demonstrated that allowing clear fluids until two hours before anesthesia significantly reduced preoperative discomfort without increasing aspiration events (17). Similarly, Carroll et al. (2022) found that shortening fasting times improved metabolic stability, maintained intraoperative hemodynamic control, and reduced caregiver stress (1). In our study, the near-complete lack of adherence to the four-hour breast milk recommendation is particularly notable, as it suggests that even the youngest and most metabolically vulnerable patients are subject to excessive fasting.

The absence of a statistically significant association between age group and fasting deviation ($p = 0.699$) indicates that this issue is systemic rather than age specific. This pattern is consistent with findings by Vanderbilt et al. (2019), who reported that deviations were widespread across pediatric age ranges and often driven by institutional factors such as surgical list delays, lack of real-time scheduling adjustments, and inadequate communication between surgical and anesthesia teams (18). In our setting, such factors are likely compounded by persistent reliance on "NPO after midnight" policies, even for procedures scheduled in the afternoon, a practice previously identified as a major contributor to fasting-related non-compliance (3,19).

Prolonged fasting in children carries well-documented physiological consequences. Hypoglycemia, dehydration, and electrolyte disturbances are more pronounced in pediatric patients due to higher basal metabolic rates and limited glycogen reserves (6). Beyond metabolic derangements, extended fasting exacerbates preoperative anxiety, increases irritability, and may elevate stress hormone levels, which in turn can influence intraoperative cardiovascular stability (20). While our results did not directly measure biochemical or hormonal outcomes, the high prevalence of multi-hour deviations suggests that many patients likely experienced some degree of preventable physiological stress. These observations support calls for institutional reform, including the implementation of liberalized fasting protocols, preoperative hydration strategies, and surgical scheduling adjustments to align actual fasting duration more closely with guideline recommendations.

The role of caregiver education is another critical consideration. Stewart et al. (2021) demonstrated that clear, multilingual preoperative instructions improved compliance and reduced excessive fasting in pediatric populations (21). In our context, it is plausible that insufficient parental understanding of guidelines contributed to both over-restriction and occasional under-restriction of intake. Given that only 1–2% of patients fasted for less than the recommended period, education should emphasize not only the minimum safe fasting times to prevent aspiration but also the potential harms of unnecessary prolongation. Coupled with standardized institutional policies, this could improve both adherence and patient comfort.

Taken together, these findings reinforce that achieving optimal NPO compliance requires a multifaceted approach: updating institutional protocols to reflect current evidence, improving real-time communication between perioperative teams, and delivering targeted caregiver education. Such interventions have been shown to reduce deviation prevalence, improve patient outcomes, and increase satisfaction among both staff and families (17,18,21). In resource-limited settings, adaptation of these strategies must consider staffing constraints, list

management challenges, and cultural perceptions of fasting. Future research should evaluate the impact of locally tailored, evidence-based fasting protocols on both clinical and patient-reported outcomes, potentially incorporating prospective biochemical monitoring to quantify metabolic benefits of reduced fasting durations.

CONCLUSION

This study demonstrates that prolonged preoperative fasting is a pervasive issue across all pediatric age groups undergoing elective surgery, with over nine out of ten patients experiencing deviations from established NPO guidelines. The most frequent pattern—fasting 2–3 hours beyond the recommended duration—reflects a systemic tendency toward conservative, outdated practices rather than patient-specific risk management. The lack of association between age and deviation magnitude indicates that excessive fasting is an institution-wide problem, driven by factors such as entrenched "NPO after midnight" policies, surgical list delays, and insufficient caregiver instruction.

This study highlights the urgent need for systematic reform in preoperative fasting practices for pediatric patients. The persistence of outdated "NPO after midnight" routines reflects a gap between global guidelines and local implementation, which compromises both patient safety and comfort. Instituting evidence-based fasting protocols requires coordinated policy updates, effective caregiver education, and improved communication between surgical and anesthesia teams to minimize unnecessary delays. Importantly, empowering parents with accurate, accessible information can reduce misconceptions and enhance compliance. Hospitals should also consider adopting flexible scheduling systems to better align fasting duration with surgical timing. By bridging these institutional and educational gaps, pediatric perioperative care can become safer, more patient-centered, and more consistent with modern international standards.

RECOMMENDATIONS

Based on the findings of this study, several recommendations can be made to improve adherence to preoperative fasting guidelines in pediatric patients. First, hospitals should revise institutional protocols to align with international standards, clearly specifying fasting durations of 2 hours for clear fluids, 4 hours for breast milk, 6 hours for light meals, and 8 hours for solids or high-fat meals. Second, surgical scheduling systems must be optimized to minimize unnecessary delays that prolong fasting times. Third, structured caregiver education, preferably multilingual and culturally appropriate, should be implemented to enhance understanding and compliance. Finally, perioperative staff should receive regular training and audits to ensure consistent practice. Together, these strategies can reduce excessive fasting and improve pediatric perioperative safety.

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