



Cross-sectional Study

# Adherence to pre-operative fasting guidelines and associated factors among pediatric surgical patients in selected public referral hospitals, Addis Ababa, Ethiopia: Cross sectional study



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## ABSTRACT

**Background:** Fasting before anesthesia is mandatory in children to reduce the complications of regurgitation, vomiting, and aspiration during anesthesia and surgery. Prolonged fasting times have several negative implications in children, because high fluid turnover quickly leads to dehydration, hypotension, metabolic disturbances, and hypoglycemia, resulting in poor anesthetic outcomes.

**Aims:** This study aimed to assess adherence to preoperative fasting guidelines and associated factors among pediatric patients undergoing elective surgery in Addis Ababa public hospitals in Ethiopia in 2020.

**Methods:** A cross-sectional survey was conducted in Addis Ababa, which selected public hospitals in Ethiopia, in 2020. A total of 279 pediatric patients aged <17 years scheduled for elective surgery were included in the study. Data analysis was performed using SPSS V.21, and the values of the variables and factors were checked for associations using logistic regression. Statistical significance was determined at P-value of <0.05. The results are presented in text, tables, charts, and graphs.

**Results:** A total of 279 pediatric patients responded to the analysis, with a 98.6% response rate. The majority of the participants (n = 251, 89.96%) did not follow the guidelines for preoperative fasting. The mean fasting time for clear liquids was 10 ± 4.03 (2–18 h) for breast milk 7.18 ± 2.26 (3.5–12 h), and for solid foods 13.5 ± 2.76 (8–19 h). The reasons for which the preoperative fasting delay was due to incorrect order were 35.1%, prior case procedures took longer times 34.1%, and changing sequence of schedule was 20.8%.

**Conclusion:** Most children had prolonged fasting. The staff's instructions and schedules were challenged to follow international fasting guidelines.

## 1. Introduction

Preoperative fasting is a prescribed time frame before a procedure when patients are restricted from oral intake of liquids or solids. Children and adults are required to fast before anesthesia with the goal of decreasing the volume and acidity of the stomach content in order to minimize the danger of regurgitation and aspiration of gastric contents during the procedure. Societies of anesthesiologists have developed guidelines that the preoperative fasting protocol should have minimum fasting period of 2 h for clear fluids, 4 h for breast milk, 6 h for infant formula, nonhuman milk, and solid foods (2:4:6). Foods that contain fatty (meat) or fried foods require eight or more additional fasting hours

[1–4].

All patients should be encouraged to drink oral clear fluids (including water, pulp-free juice, and tea or coffee without milk) up to 2 h before elective surgical procedures [3]. Children's who have taken clear liquids and liquid enriched with carbohydrates till 2 h before the procedure have less hunger and thirst, lower rates of dehydration, and better hemodynamic stability [5–8].

Prolonged preoperative fasting can rapidly result in dehydration and the requirement for fluid replacement during anesthesia in addition to increasing the potential for replacing blood lost during the surgery [6]. Patients fasted for a delayed time, higher than the recommended, and the degree of discomfort such as hunger and thirst increased over time.

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Therefore to improve recovery and patient comfort, it is important to build up a preoperative fasting protocol to reduce the risk of adverse events which has led several of the main societies, that is, The Association of Anaesthetists of Great Britain and Ireland (AAGBI) and American Society of Anesthesiologists' (ASA) to develop new guidelines that support more liberal preoperative fasting time guidelines [9,10].

Further, in Africa, a caregiver with poor education, who cannot bear the hunger of her child any longer, might feed the child shortly before surgery without informing the Anesthetist [19]. In our setting most of the caregiver are a child mother or father and they fear that the surgery is difficult unless the child has got eaten as soon as before the procedures. Thus, there is now study in our country regarding this topic, the present study aims to assess preoperative fasting adherence to the guidelines and associated factors as a baseline.

**2. Materials and methods**

**2.1. Study setting and population**

A survey was conducted from January-2020 to March-2020 in Addis Ababa, Ethiopia. This study was conducted in selected public hospitals in Addis Ababa; the capital city of Ethiopia, which is the largest city in Ethiopia with an area of 530 km<sup>2</sup> with a population of 3,384,569 according to the 2007 population census. There are 13 public hospitals in the city. Of these hospitals, 11 underwent pediatric surgeries.

All elective pediatric surgical patients (neonates, infants, and children up to the age of 17 years) with ASA class I and II preoperatively on the fasting protocol were included in the study, whereas pediatric patients who were coming for emergency surgery were excluded from the study. Preoperative fasting adherence is a patient who follows the international minimum protocol of fasting 2:4:6 (for liquids, breast milk and solids respectively) during the preoperative periods.

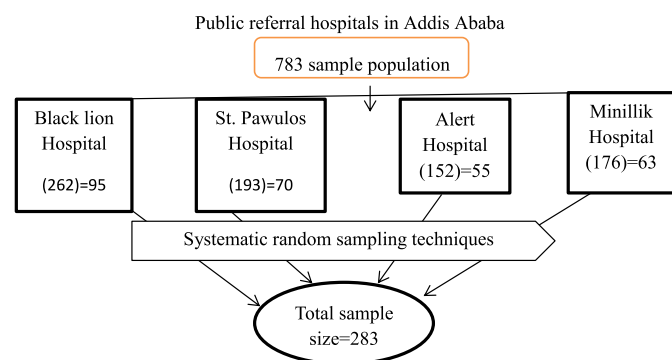
This research has been reported in line with the STROCSS criteria 2021 [23]. And this work has a Research Registry UIN number "researchregistry7910" which accessed through <https://www.researchregistry.com/browse-the-registry#home/>.

**2.2. Sample size and sampling procedure**

This was a descriptive cross-sectional study involving systematically selected respondents (n = 283) from four public city hospitals conducted between January 2020 to March 2020. The sample size calculation was based on a single population proportion formula was used by assuming that the prevalence of preoperative fasting adherence as 0.5 with a 5% margin of error at 95% confidence interval (Fig. 1).

**2.3. Data collection procedures**

Data were collected from the patient caregivers and medical records



**Fig. 1.** Schematic presentation for sampling techniques of adherence to preoperative fasting in Addis Ababa selected Public hospital, 2020.

using questionnaires. The data collectors had obtained consent from caregivers, reviewed the patient's chart, documented sociodemographic, preoperative assessment, and preoperative fasting orders, and reviewed the patients' medical records in reception area before anesthesia. Information on types of food entailed, NPO hours, and the reason why their child had fasting protocols were asked by the patient's caregivers.

**2.4. Data quality management**

Supervisors and data collectors were trained for half a day on the data collection instrument and its administration, objectives, and the rights of respondents. In order To ensure the quality of the data, a pre-test was performed on 15 patients (5% of the sample size) who were not included in the main study. Then, necessary corrections were made to the questionnaire for the main study. Regular daily supervision of the data collectors and cross-checking for completeness and accuracy of the data was made by the principal investigator. Finally, coding, data entry, data cleansing, and cross-checking were performed before data analysis.

**2.5. Data processing and analysis**

The data were originally coded and entered into the EPI INFO version 7(WHO) statistical packages. The data were then transferred to SPSS version 21 (IBM) for analysis. Recoding and re-categorization were performed for the selected relevant variables. Descriptive statistics were used to summarize the data using tables, percentages, graphs, figures, and mean values. With the aim of the study to assess the fasting adherence and factors associated with prolonged fasting the strength of association between variables was determined using bivariate and multivariable logistic regression, and odds ratios, with 95% confidence intervals. Statistical significance was P < 0.25 for bivariate regression and P < 0.05 for multivariate regression. P-value of less than 0.05 was considered as statistically significant.

**3. Results**

**3.1. Socio-demographic characteristics of the participants**

A total of 279 pediatric patients were recruited for the analysis with a 98.6% response rate. Participants' age, sex, caregivers' relationships, and levels of education were assessed in this character. Patients' age of one month-two years was 57 (20.4%). Of the respondents, 154 (55.2%) were male. Caregivers relationships with their children, 189 (67.7%) were mothers, 68 (24.4%) were fathers and 22 (7.9%) were others. Eighty-one (29%) of the caregivers had a secondary school level of education. (Table 1).

**Table 1**  
Socio-demographic characteristics of the study on adherence to preoperative fasting guidelines and associated factors among pediatric surgical patients from January to March 2020 (N = 279).

Variables	Categories	N (%)
Patients Age (in year)	1month – ≤2 years	57 (20.43%)
	2 years–17 years	222(79.57%)
Sex	Male	154 (55.20%)
	Female	125 (44.80%)
Care givers relationship	Mother	189 (67.74%)
	Father	68 (24.37%)
	Others (Sister, Brother ...)	22 (7.89%)
Level of education of care givers	Illiterate	37 (13.30%)
	Can read and write	67 (24%)
	Primary school (1–8)	60 (21.50%)
	Secondary school (9–12)	81 (29%)
	College and above	34 (12.2%)

### 3.2. Perception of caregivers on preoperative fasting protocols

Based on the responses of the respondents, out of (n = 279) the study participants, 201 (72%) of them responded that they had known the reason why their children had fasted before anesthesia and surgery. The majority of the respondents said that the reasons they perceived to be fasting before surgery 108 (38.7%) had said the requirement for surgery, followed by preventing anesthesia complications 37 (13.3%) and avoiding vomiting were 30 (10.8%) (Fig. 2).

### 3.3. Source of preoperative fasting instructions

As regards to the sources of preoperative instruction orders that were given by nurses, 121 (43.4%) followed by surgeons 95 (34.1%) and Anesthetists 59 (21.2%) before the day of surgery during preparing the patients (Fig. 3).

### 3.4. Types of procedures and America Society of anesthesiologists (ASA) physical status

With regard to the types of the procedures about 114 (40.9%) of the patients were scheduled for general surgery, followed by 68 (24.4%) for them orthopedic surgery and the rest were scheduled for urology, ENT, and other procedures. The majority of the respondents had ASA physical class status of I (78.9%) and ASA physical status of II (21.2%) (Fig. 4).

### 3.5. Descriptive on fasting time for food for elective pediatrics patients

The study population (n = 279) comprised patients with mean age of  $6.6 \pm 4.5$  years. All participants' were asked about their last meal instruction times, and they reported that the mean NPO hours for clear liquids were  $10 \pm 4$  (ranges 2–19 h). The mean fasting hours for breast milk was  $7.2 \pm 2.3$  (ranges 4–12 h) and the mean NPO hours for solid foods  $13.5 \pm 2.8$  (ranges 8–19 h).

### 3.6. Preoperative fasting hours adherence to guidelines on different food entails

Most of the participants fasted for clear liquids, 99 (91.7%) were above the guideline hours, and only nine (8.3%) of them adhered the

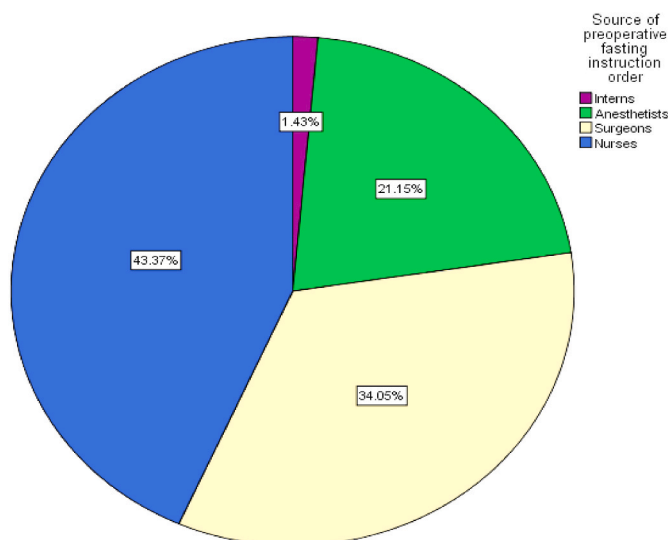


Fig. 3. Source of preoperative fasting instructions orders delivery in selected Public referral Hospitals, Addis Ababa, 2020.

protocol for clear liquids. Out of 279 study participants, 44(15.8%) had breast milk feeding and who adhered the guidelines were nine (20.5%) and 35 (79.6%) did not adhere to the guidelines protocol.

Majority of the participants 117 (92.1%) did not adhere the guidelines of preoperative fasting protocols for solid foods, whereas ten (7.8%) of the participants adhered to protocols.

Of the total 279 participants, only twenty eight (10%) were adhered the preoperative fasting international guidelines (Table 2).

### 3.7. Preoperative sequence of schedule and reasons of delaying to surgery

From the participants, 75 (26.9%) were scheduled as 1st cases, 81 (29%) as 2nd cases, 73 (26.2%) as 3rd and 50 (17.9%) as 4th cases in daily procedures.

About ninety-eight (35.1%) responded to the reason why the preoperative fasting was delayed due to incorrect order of fasting prescriptions. The second reason was that prior procedures took longer time

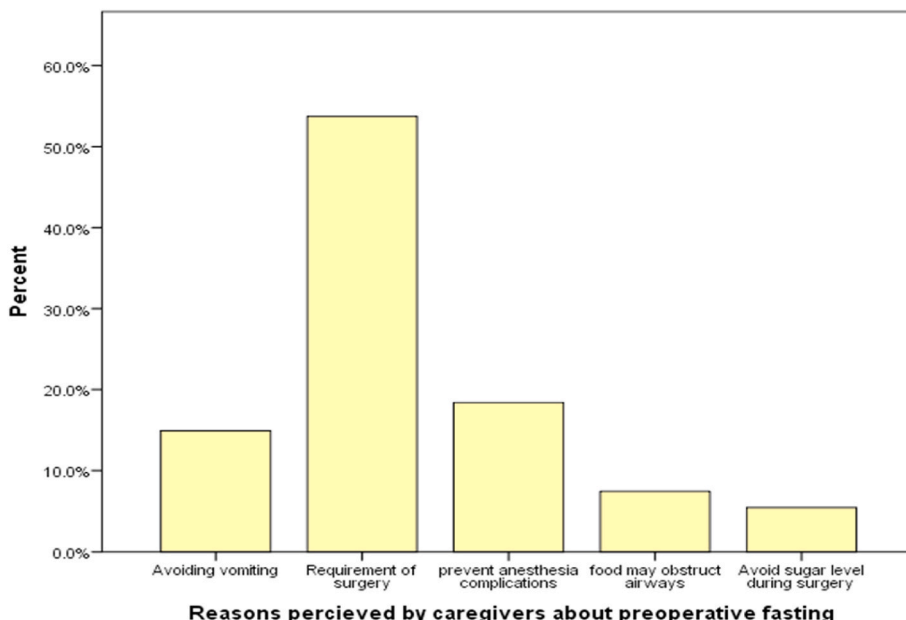


Fig. 2. Perception of caregivers' reasons on preoperative fasting in selected Public referral Hospitals, Addis Ababa, 2020.

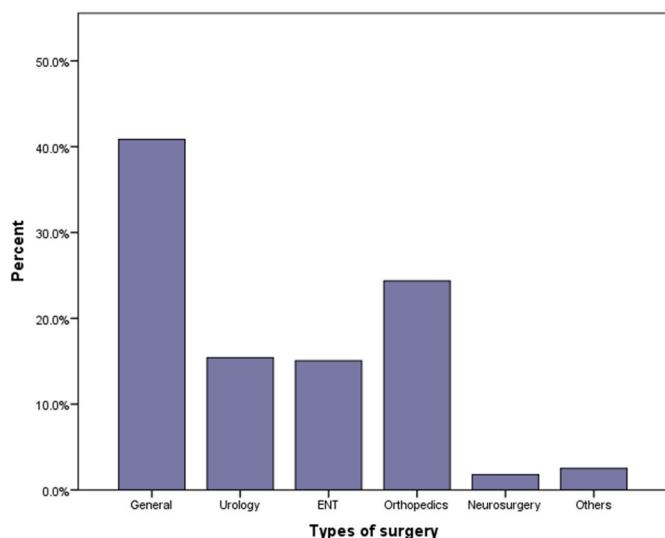


Fig. 4. Types of pediatric surgical procedures in selected Public referral Hospitals, Addis Ababa, 2020.

Table 2

Frequency of preoperative fasting hours on different food entails on the study of adherence to preoperative fasting guidelines in selected Public referral Hospitals, Addis Ababa, 2020, (N = 279).

Variables	Categories	N (%)	Total%	
Preoperative fasting hours	Clear	=<2hrs	9 (8.33%)	108
	liquids	>2hrs	99 (91.67%)	(38.7%)
		Breast milk	=<4hrs	9(20.45%)
	Solid foods	>4hrs	35 (79.55%)	
		=<8hrs	10 (7.87%)	127
		>8hrs	117 (92.13%)	(45.5%)
Adhere to guidelines	Yes	28(10.04%)	279(100%)	
	No	251 (89.96%)		

95 (34.1%) to delay the next procedures, and changing the sequence of schedule in the morning was 58 (20.8%) other reasons. Of the all study patients, only twenty-eight (10%) of the patients had an on-time procedure was performed (Table 3).

### 3.8. Factors associated with prolonged preoperative fasting

#### 3.8.1. Bivariate analysis

The selected sociodemographic characteristics of the participants' variables such as sex, caregiver relationship, types of procedures, and ASA classes failed to show statistical significance, whereas in the

Table 3

Preoperative cases sequence and reasons of delaying fasting among pediatric surgical patients in selected Public referral Hospitals, Addis Ababa, 2020(n = 279).

Variables	Categories	Number (%)
Sequence of patients schedule	1st	75 (26.9%)
	2nd	81 (29%)
	3rd	73 (26.2%)
	4th	50 (17.9%)
Reasons to delayed of fasting time	Prior case procedures takes long times	95 (34.1%)
	Change order of cases sequences	58 (20.8%)
	Incorrect order is given	98 (35.1%)
	Not delayed	28 (10.0%)

bivariate analysis method participants' age, levels of education, the sequence of patients' schedule, and sources of instruction were significant with a P-value < 0.25.

Age was significantly associated with prolonged preoperative fasting. Those patients whose age increased by one year had odds of 11.8% less likely to have a prolonged preoperative fasting p (0.024) [AOR: 0.88, 95% CI (0.79, 0.98)].

Statistical significance was observed for the sequence of patient schedules. Patients who were scheduled for 3rd and above cases were 77.7% less likely to have prolonged fasting times than cases scheduled as 1st cases p (0.025) [COR: 0.22, 95% CI (0.08, 0.61)].

A statistically significant association was also found between preoperative fasting order instructions and adherence to guidelines. The orders given by the surgeons and interns were 70.2% less likely to be associated with preoperative fasting prolongation than orders was given by nurses with p (0.037) COD: 0.29, 95% CI [(0.09, 0.92)].

Participants' caregivers' levels of education status, primary and above were, 59.5% less likely to be associated with prolonged preoperative fasting than educational levels with illiteracy and ability to read and write p (0.025) [COR, 0.40, 95%, CI(0.18, 0.89)].

#### 3.8.2. Multivariable analysis

Statically significance that found in bivariate analysis was not associated with multivariate analysis; however only sequences of patient schedules as 3rd and above cases were 76.7% less likely statistically associated with 1st and 2nd cases. P (0.006) [AOR: 0.23, 95% CI (0.08, 0.66) (Table 4).

## 4. Discussion

The results of this study revealed that the importance of preoperative fasting adherence to guidelines in improving unnecessarily prolonged fasting practices and patient comfort in the perioperative period. This was the first survey to assess preoperative fasting hours in children in our study area. This study showed that the majority of participants who were undergone elective surgery (90%) had prolonged NPO instructions, whether they were scheduled for an early or late procedure. Our study is similar to study conducted at a major teaching hospital at Gondar University. The majority of patients fasted for both fluid (95%) and solid food (92%) longer fasting hours than those recommended by the international fasting guidelines [11].

Based on our findings, the overall prevalence of preoperative fasting adherence to guidelines was 10%. Our study also tried to show this incidence in line with study done in which 96.1% of patients reported preoperative prolonged fasting times [12]. This study is also comparable with study conducted in Japan majority of the patients (90%) fasted from fluid longer than the recommended preoperative fasting hours of the guidelines [13].

Of the study patients, 8.3% had fasted for clear liquids, which were adhered to protocol (2hrs). A similar study was done in Pakistan only 2.9% children had fasted for clear liquids according to the recommended fasting time (2 h) [13]. The difference in the study might be due to relatively small samples.

The study showed that children who experienced excessive fasting experienced a lot of preoperative discomfort. The majority of children fasted as instructed were severely hungry, thirsty, anxiety, and drowsiness due to that the times of fasting are still too long [14]. Even though, there may be different reasons behind for extended fasting, including children being fed earlier in the evening and sleeping for longer on the night before [15]. A study was done by Endale G.(2014) showed that 49% of patients had experienced slight to severe thirst due to prolonged fasting from fluid [11]. This implies that children in waiting of the procedure faced unnecessary stressful and metabolic discomfort. However, several meta-analyses of trials showed that children who fasted preoperatively for more than 6 h from oral fluids did not benefit from intraoperative gastric volume and pH as compared with those who were

**Table 4**

Factors associated with adherence to preoperative fasting guidelines analyzed in logistic regression study among pediatric surgical patients in selected Public referral Hospitals, Addis Ababa, 2020 (n = 279).

Variables		Fasting hours adherence to guidelines		Odds ratio (95% CI)			
		Yes N (%)	No N (%)	Crude (95% CI)	P value	Adjusted (95% CI)	P value
Age	1month –17 years	28 (10.04)	251 (89.96)	0.864(0.775, 0.962)	0.008*	0.882(0.791, 0.983)	0.024**
Sequence of patient schedule	1st	14 (18.67)	61(81.33)	1.00		1.00	
	2nd	8(9.87)	73(90.13)	0.477(0.188, 1.214)	0.120*	0.526(0.197, 1.407)	0.201
	3rd and above	6(4.87)	117 (95.13)	0.223(0.082, 0.611)	0.003*	0.233(0.082, 0.660)	0.006**
Levels of caregivers educations	Illiterate and Can read and write	16 (15.38)	88(84.62)	1.00		1.00	
	Primary school and above	12(6.86)	163 (93.14)	0.405(0.183, 0.894)	0.025*	0.453(0.193, 1.063)	0.069
Sources of preoperative fasting instruction	Nurses	15(12.4)	106(87.6)	1.00		1.00	0.487
	Anesthetists	9(15.25)	50(84.75)	1.27(0.521, 3.104)	0.597	1.406(0.538, 3.672)	
	Surgeons and Interns	4(4.04)	95(95.96)	0.298(0.095, 0.928)	0.037*	0.332(0.101, 1.077)	0.066
Do you know why your child is fasting before anesthesia and surgery	Yes	17(8.46)	184 (91.54)	1.00		1.00	
	No	11 (14.11)	67(85.89)	1.77(0.79, 3.98)	0.163*	1.37(0.555, 3.397)	0.493

\*- bivariate significant,  $p < 0.25$  \*\*- multivariate statically significant  $P < 0.05$ .

allowed unlimited liquids up to 2 h before surgery [16].

This study showed that the mean fasting time to liquids and solids was higher than that recommended by the ASA. NPO hours for clear liquids were  $10 \pm 4$  (Ranges 2–18 h), the mean hours for breast milk  $7.18 \pm 2.3$  (Ranges 3.5–12 h) and the mean hours for solid foods  $13.5 \pm 2.8$  (Ranges 8–19 h). This study is comparable with the study was done by Cestonaro et al. (2014) showed that 16.5 h of mean fasting hours for solids and 15.75 h for liquids in a university public hospital in the South of Brazil. A study published by Aguilar-Nascimento et al. showed also supported our findings that the median fasting for 13 h (6–21 h) in a group that used the traditional recommendations [4]. Another audit study also found similar evidence that the conventional preoperative fasting hours were prolonged more than 50% of the patients fasted twice longer than the guidelines [11].

Another study indicated that the mean fasting time for clear liquids is 7.65 times and for solids 2.5 times longer than the preoperative fasting times recommended by ASA [18]. Children were being starved of water for a mean of 8.5 h, which exceeds the recommendations of all international guidelines [19]. A study was done by Arun B. on preoperative fasting hours for solids and milk (breast and nonhuman) was between 4 h and 18.75 h ( $11.25 \pm 3.5$  h) and clear liquid (water) ranged between 2 h and 18.75 h ( $9.25 \pm 4.25$  h) [20]. Children who had surgery in the morning fasted longer for solids than children who had surgery in the afternoon because of an overnight fast after the evening meal [17].

Our study showed that sources of instruction orders were given by nurses was 121 (43.4%) followed by surgeons 95 (34%) and anesthetists were 59 (21.2%) during in the preoperative visit time. A similar study of 63.8% of patients had been verbally instructed by anesthetists regarding preoperative fasting and 97.9% by nurses' respectively [20]. The study regarding fasting instructions delivery reports to patients was by nurses (56.9%) and by doctors (43.1%) [18]. The difference may be the source of instruction delivered by different groups.

Our study reported that the reasons for delayed fasting times of 98 (35.1%) were due to incorrect orders of fasting instructions given by staff. The other reason to delay fasting time was that prior case procedures took longer times (95 [34.1%]) and changing the sequence of schedule lists in the morning was 58 (20.8%). Studies comparing our findings showed that 59.5% of the previous cases took longer than

scheduled were the most frequent reason for prolonged patient fasting time followed by case order of sequence changes (14.3%). However, there is prolonged fasting, which can be caused by changes to the list order or the addition of emergency cases [22]. This might also be the reason for our cases. A study by Arun B. showed that rescheduling of cases 30% of cases and incorrect nurses' order of 74% were the causes for delayed fasting time [21]. Therefore, incorrect orders of instructions and changing sequences of cases schedule with inadequate information delivery still challenged the fasting practice.

Our study findings also shared the challenges to evidence by an audit in Ethiopia; the implementation of fasting guidelines lacks a fasting protocol at the national and local levels, lack of knowledge about the benefits of adherence to fasting protocol, the adverse effect of prolonged fasting, lack of auditing in the hospitals, and absence of an initiative committee [11].

In a teaching hospital, as in our study, overemphasizing teaching may adversely affect the patient's experience of fasting. Preoperative cases are often delayed in the operating room and majorly affect patient flow, which results in prolonged fasting [20,22].

In this study, we observed that traditional nil per oral (NPO) instructions after midnight for clear liquids, breast milk, and solids inadvertently lead to prolonged fasting. This may explain why, despite reasonable evidence, anesthetists still need 2:4:6 rules for fasting in children.

The main thing that we suppose as a limitation from our study is shortage of adequate references to compare the associated factors that prolong fasting. We recommend the sequence of the patients' scheduled time and the fasting instruction with the time of the proposed procedure should be coordinated. Staff at the preoperative visit should check the sequences of lists before delivering fasting instructions, which should be harmonized with the time of the procedure.

## 5. Conclusions

In conclusion, we found that the fasting times for pediatric patients in our study were typically far longer than the current guidelines. The sequence of patient schedules and instructions delivered by staff was the cause of unnecessary prolonged fasting experiences in children.

## Ethical approval

Addis Ababa University college of health sciences ethical committee approved this research.

## Funding

This work was supported by Addis Ababa University.

## Authors' contributions

Aragaw Hamza Yimer: writing the paper, data collection, Lidiya Haddis: writing the paper, data collection, Meron Abrar: writing the paper, data collection, Ahmed Muhye Seid: data analysis or interpretation, writing the paper.

## Data availability

Due to the ethical restriction and privacy concern, a dataset is available upon request from the corresponding author, Aragaw Hamza: [aragaw2010@gmail.com](mailto:aragaw2010@gmail.com).

## Registration of research studies

This work has a Research Registry UIN number "researchregistry7910" which accessed through <https://www.researchregistry.com/browse-the-registry#home/>.

## Guarantor

Mr. Aragaw H. Yimer.

## Consent

Ethical clearance was obtained from the ethical Review Board of Addis Ababa University (AAU), permission and letter of cooperation for the hospitals were obtained from the department of anesthesia. Objective of the study was explained and permission was obtained from the clinical service coordinator of the hospital. The data collectors had obtained consent from caregivers, participant records were coded and only accessed by the research team; hence, confidentiality of participant records and privacy of the health facility were secured.

## Declaration of competing interest

We declare that there are no conflicts of interest.

## Acknowledgement

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## Abbreviation

AAGBI Association of Anaesthetists of Great Britain and Ireland  
ASA American society of Anesthesiologists

CI Confidence Intervals  
ENT Ear Nose and Throat  
ESA European society of Anesthesiologists  
Hrs Hours  
NPO No Per Os  
PONV Post Operative Nausea and Vomiting

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.103813>.

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