Article

Beyond Guidelines: The Persistent Challenge of Preoperative Fasting Times

Ricardo Euzébio Ribeiro Silva Junior , Camila Soriano , Pablo Lima , Bruno Fernandes de Oliveira Santos , Wesley Pereira , Marcos Torres de Brito Filho , Julio Brandão , Marcos Adriano Lessa *

Posted Date: 11 October 2023

doi: 10.20944/preprints202310.0743.v1

Keywords: anesthesia; perioperative care; dehydration; fasting; pulmonary aspiration

Article

Beyond Guidelines: The Persistent Challenge of Preoperative Fasting Times

Ricardo E. R. S. Júnior [1], Camila A. Soriano [2], Pablo A. S. Lima [1], Bruno F. O. Santos [1], Wesley G. N. Pereira [1], Marcos T. B. Filho [1], Júlio C. Brandão [1] and Marcos A. Lessa [3,4,*]

[1] Medical School, Federal University of Sergipe, Brazil.
[2] National Institute of Cancer, Rio de Janeiro, Brazil.
[3] Laboratory of Clinical and Experimental Pathophysiology, Oswaldo Cruz Institute – Fiocruz, Rio de Janeiro, Brazil.
[4] Department of Surgery, Anesthesia Division, College of Medical Science, State University of Rio de Janeiro, Brazil
* Correspondence: number: +552125621312; Corresponding author's e-mail: malessa@ioc.fiocruz.br

Abstract: Despite the advancements in evidence-based medicine, many hospitals still maintain high rates of patients undergoing prolonged preoperative fasting. The goal of this study is to determine the prevalence of prolonged fasting time among patients undergoing elective surgeries at a Brazilian university hospital and its associations with clinical and sociodemographic variables. This cross-sectional study was conducted between May and November 2019 and included patients of all ages undergoing elective surgeries. Out of the 293 patients analyzed, 64.2% were male, with ages ranging from 1 to 85 years, and 93.9% were classified as ASA I or II. The prevalence of preoperative fasting exceeding 8 hours was 89.4%. An average fasting time exceeding 11 hours was observed across all age groups. Patients who underwent procedures in the afternoon had an average fasting time that was 16% longer than those in the morning period (13.84 vs. 11.92, $p<0.001$). Surgery time ($r=0.134$, $p<0.03$) and anesthesia times ($r=0.121$, $p<0.04$) demonstrated a weak correlation with fasting time. Despite the international consensus on preoperative fasting time, our study demonstrated low adherence to current recommendations. Therefore, healthcare professionals should ensure the comprehension of fasting guidelines, and further studies should aim to identify effective solutions to mitigate prolonged fasting.

Keywords: anesthesia; perioperative care; dehydration; fasting; pulmonary aspiration

1. Introduction

In 1855, the inaugural recommendation for preoperative fasting emerged to mitigate the risk of vomiting during chloroform inhalation [1]. By 1946, the advent of Mendelson's Syndrome, typified by chemical pneumonitis following pulmonary aspiration of gastric contents during anesthesia induction, prompted the universal adoption of an 8-hour preoperative fasting regimen. This duration was empirically ascertained to accommodate gastric emptying [2]. Nevertheless, it is now unequivocally recognized that protracted fasting can augment insulin resistance, exacerbate the metabolic response to surgical stress, and correlate with heightened incidences of nausea, vomiting, dehydration, thirst, hunger, anxiety, and, consequentially, elevated morbidity, mortality rates, infections, prolonged hospital stays, and healthcare expenditures [3–13].

In a bid to counterbalance the detrimental ramifications of extended fasting, optimize the metabolic profile of patients, and concurrently diminish the peril of gastric content pulmonary aspiration, contemporary guidelines advocate for abbreviated fasting. This regimen permits the intake of a clear carbohydrate solution for a mere 2 hours for healthy patients before surgical intervention and a 6-hour fast for light solid foods. Crucially, anesthesiologists should recognize conditions that may increase the risk for regurgitation and pulmonary aspiration, including uncontrolled reflux disease, hiatal hernia, achalasia, previous gastric surgery, diabetes mellitus, opioid use, pregnancy, obesity, and emergency procedures. As such, they should be prepared to modify these guidelines based on clinical judgment. Prevailing literature avers that this modus operandi not only elevates patient comfort and prognosis but also does not intensify the risk of pulmonary aspiration [6,8,14,15]. Yet, even with copious corroborated evidence, the translation of these guidelines into clinical praxis remains an elusive endeavor [3,16,17].

Subsequent studies underscore that a multitude of hospitals persistently maintain fasting durations that egregiously exceed recommended parameters, an observation that remains startlingly consistent nearly two decades post the inauguration of the Enhanced Recovery After Surgery (ERAS) protocol and the substantiated merits of abbreviated fasting [18]. The literature enumerates myriad reasons for this divergence from prescribed guidelines, encompassing surgical scheduling discrepancies, the socioeconomic and cultural fabric of the patient demographic, logistical impediments, the entrenched convention of endorsing midnight fasting, and professional convictions that deviate from empirical evidence [17,19].

Given this backdrop, the present study aspires to augment the extant literature by underscoring the palpable gap in the assimilation of guidelines for abbreviated preoperative fasting. Our foremost objective is to scrutinize the compliance of a university hospital with contemporary directives. Concurrently, we endeavor to present a succinct review of the merits of abbreviated fasting and juxtapose our insights with those chronicled in academic literature.

2. Methodology

2.1. Participants

We conducted an observational cross-sectional study at a Brazilian university hospital from May to November 2019. The cohort encompassed patients slated for elective surgeries, whether under sedation, general anesthesia, or neuroaxis blockade, always in the presence of an anesthesiologist. Participant inclusion remained agnostic to age, gender, or comorbidity criteria. Of the initial 361 patients considered, we excluded 68 due to either surgery cancellations or insufficient data acquisition. This research was executed across the two surgical centers of the University Hospital of the Federal University of Sergipe (UH – FUS) and procured approval from the Institutional Research Board (Certificate number: 13354118.2.0000.5546).

2.2. Study Design

On the scheduled surgery day, we engaged patients or their designated caregivers in the pre-operative holding arena to disseminate and gather data via questionnaires. Preliminary data extraction included variables like sex, age, weight, height, Body Mass Index (BMI), American Society of Anesthesiologists (ASA) score, and the timestamp marking the commencement of fasting. Post-operatively, we accumulated data detailing the duration of surgery and anesthesia, their respective types, and any perioperative complications. These details were sourced from anesthesia records and corroborated with information vouched for by the overseeing anesthesiologist. We discerned the total fasting duration by computing the difference between the anesthetic induction time and when fasting began.

2.3. Statistical Analysis

For categorical variables, we depicted them using both absolute and relative frequencies. Continuous variables were elucidated with metrics such as the mean, standard deviation (SD), median, and interquartile range. We employed the Shapiro-Wilk test to gauge the normal distribution of continuous variables across distinct groups. As our data did not adhere to normal distribution assumptions, we resorted to the Mann-Whitney test (for binary groups) and the Kruskal-Wallis test (for ternary groups or higher) to validate the homogeneity of central tendency measures. Subsequent multiple comparisons leveraged the Mann-Whitney-Holm test. We assessed both the non-existence and magnitude of correlations between continuous variables via Spearman's correlation. Our

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 October 2023 doi:10.20944/preprints202310.0743.v1

significance threshold stood at 5%, and for all statistical operations, we utilized the R Core Team 2020 software package.

3. Results

A cohort of 293 patients was incorporated into our study, with a female predominance of 64.2%. The mean age stood at 37.36 years (SD ± 21.95), spanning from under a year up to 85 years. In terms of the ASA score, 47.5% were stratified as ASA I and 49.3% as ASA II. The cohort had a negligible representation of ASA III or ASA IV patients, and completely lacked ASA V or ASA VI individuals. A comprehensive breakdown of demographic and clinical parameters is delineated in Table 1.

Table 1. Demographic and clinical characteristics of patients.

.	n (%)	Mean (SD)	Median (IQR)
SC			
1	249 (85)		
2	44 (15)		
ASA			
1	135 (46.1)		
2	140 (47.8)		
3	7 (2.4)		
4	2 (0.7)		
Gender			
Female	188 (64.2)		
Male	104 (35.5)		
Age (in years)	290 (99)	37.36 (21.95)	39 (16.8-56)
0 to 9 years	44 (15.18)		
10 to 14 years	25 (8.6)		
15 to 24 years	23 (7.9)		
25 to 59 years	145 (50.0)		
from 60	53 (18.3)		
BMI (kg/m²)	190 (64.8)	26.32 (7.85)	25.6 (22.1-29.4)
Height (m)	185 (63.1)	1.62 (1)	1.6 (1.5-1.7)
Weight (kg)	269 (91.8)	60.5 (26.1)	63 (48-75)
Shift			
Morning	129 (44)		
Afternoon	164 (56)		
Anesthesia Time (h)	293 (100)	2.06 (1.47)	1.8 (1-2.8)
Surgery Time (h)	293 (100)	1.45 (1.26)	1.1 (0.5-2.1)
Type of Surgery			
Open Abdominal	53 (18.1)		
Abdominal by video	47 (16)		
Endoscopy	25 (8.5)		
Pediatric	55 (18.8)		
Plastic	12 (4.1)		
Thoracic	6 (2)		
Others	95 (32.4)		
Type of Anesthesia			
General Anesthesia	169 (57.7)		
Neuraxial blockade	68 (23.2)		
Combined	21 (7.2)		
Sedation	35 (11.9)		
Hypotension			
Yes	19 (6.5)		
No	274 (93.5)		
Nausea/vomiting			
Yes	3 (1)		
No	290 (99)		

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 October 2023 doi:10.20944/preprints202310.0743.v1

Fasting (h)	293 (100)	13 (3.98)	12.8 (10-15.5)
0-8	31 (10.6)		
8-12	106 (36.2)		
12-16	98 (33.4)		
>16	58 (19.8)		

n – absolute frequency. % – relative percentage frequency. SD – Standard Deviation. IQR – Interquartile Range. SC – Surgical Center. ASA – American Society of Anesthesiologists. BMI – Body Mass Index.

Surgical interventions were organized into six distinct classifications: open abdominal, video-assisted abdominal, endoscopic, pediatric, plastic, and thoracic. Procedures eluding these categories were bracketed under "others". Pediatric surgeries emerged as the predominant category, accounting for 18.8%, while thoracic interventions were scant at 2%. The study identified four anesthesia modalities, which include neuraxial blocks, general anesthesia, sedation, and a combined approach (general anesthesia + neuraxial blockade). This information, sourced directly from anesthesia logs, highlighted general anesthesia as the principal modality, with a prevalence of 57.7%.

For procedural durations, the average spanned 1.45 hours (SD ± 1.26) while anesthesia averaged 2.06 hours (SD ± 1.47). A majority (56%) of surgeries were scheduled for the post-noon window, commencing from 1 p.m. Notably, perioperative episodes like hypotension (6.5%) and nausea/vomiting (1%) were meticulously documented by the assigned anesthesiologist. Instances of pulmonary aspiration were absent.

Delving into fasting durations, the mean was clocked at 13 hours (SD ± 3.98), with a median of 12.8 hours. A mere 10.6% (n=31) of participants adhered to the 8-hour fasting guideline. Alarmingly, 53.2% (n=156) surpassed the 12-hour mark, as depicted in Figure 1. The longest fasting episode spanned a staggering 27 hours in a 42-year-old female, categorized as ASA I, who underwent a bilateral sinusotomy under general anesthesia. In stark contrast, the shortest fasting duration was a brief 2.5 hours in a 50-year-old male, ASA I, who received a hemorrhoidectomy under sedation.

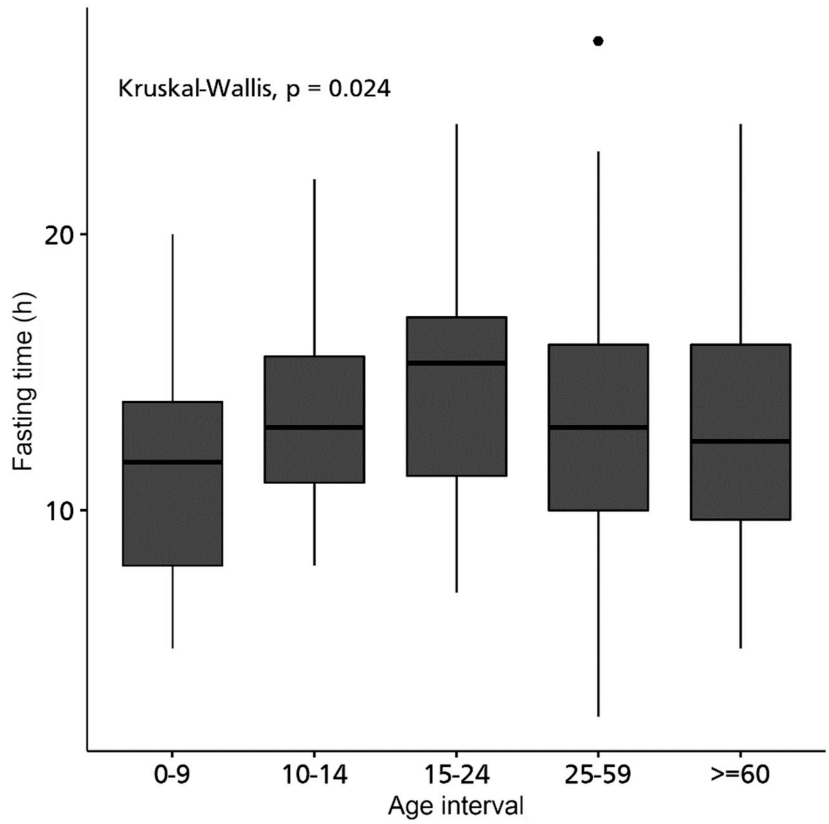

Figure 1. Patients' distribution according to the preoperative fasting duration.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 October 2023 doi:10.20944/preprints202310.0743.v1

A notable 89.4% breached the 8-hour fasting benchmark. Afternoon procedures witnessed fasting durations that were approximately 16% lengthier compared to their morning counterparts (13.84 vs 11.92, $p < 0.001$). Among various age demographics, those aged 15 to 24 years exhibited the longest fasting durations, contrasting with pediatric subjects up to 9 years who recorded the briefest (14.55 vs. 11.41, $p < 0.005$). A significant variance was also observed between the age group 25 to 59 years versus the pediatric demographic (13.25 vs. 11.1, $p < 0.006$). Fasting durations were invariant when evaluated against gender, surgical center, ASA score, surgical, or anesthesia type. An extensive analysis of average fasting time across demographic and clinical variables is showcased in Table 2, Figures 2 and 3.

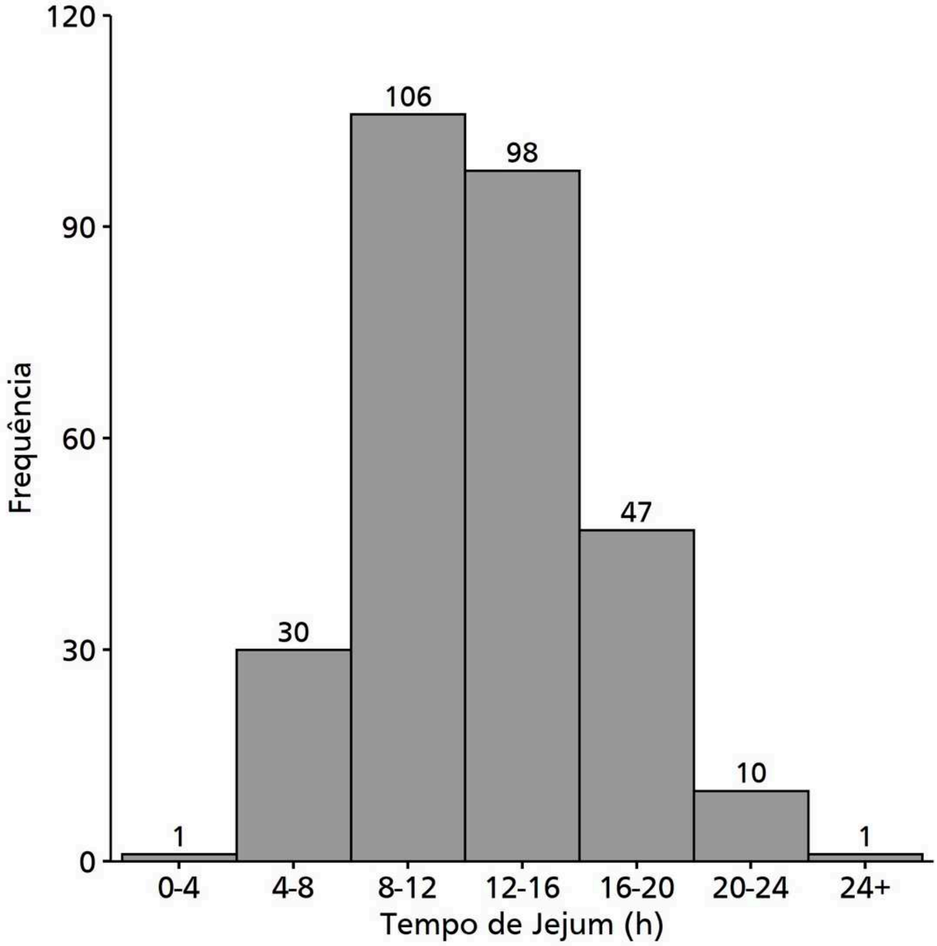

Figure 2. Relationship between fasting time and different age intervals.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 October 2023 doi:10.20944/preprints202310.0743.v1

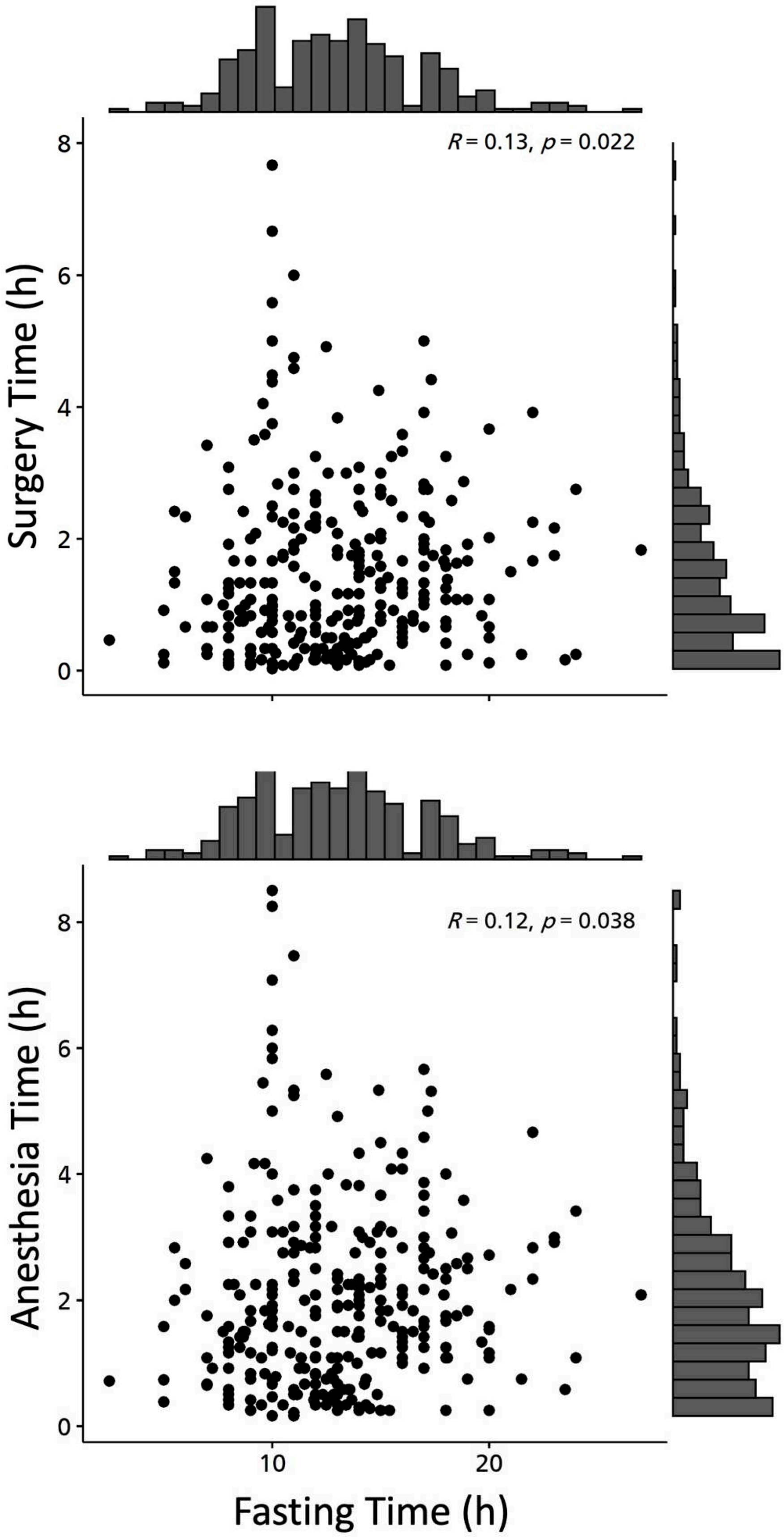

Figure 3. Scatterplots between surgery and anesthesia times x fasting time.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 October 2023 doi:10.20944/preprints202310.0743.v1

Table 2. Demographic variables and mean fasting duration.

	Fasting (h)		
	Mean (SD)	**Median (IQR)**	**p-value**
SC			
1	13.16 (4.08)	13 (10-16)	0.092
2	12.04 (3.19)	12.4 (9.8-14)	
ASA			
1	13.05 (4.41)	13 (10-15.5)	0.814
2	13.1 (3.71)	13 (10-16)	
3	12.19 (1.3)	12.5 (10.5-13)	
4	11 (1.41)	11 (10-0)	
Gender			
Female	13.09 (4.12)	12.6 (10-15.9)	0.824
Male	12.8 (3.73)	13 (10-15)	
Age (in years)			
0 to 9 years to	11.41 (3.37)	11.75 (8-13.98)	0.021
10 to 14 years [a,b]	13.41 (3.37)	13 (11-16.29)	
15 to 24 years [b]	14.55 (4.56)	15.33 (10.5-17)	
25 to 59 years [a,b]	13.25 (4)	13 (10-16)	
From 60 [a,b]	12.8 (4.17)	12.5 (9.62-16)	
Shift			
Morning	11.92 (2.48)	12 (10-13.5)	<0.001
Afternoon	13.84 (4.67)	14.9 (9.7-17)	
Type of Surgery			
Open Abdominal	13.7 (4.22)	14 (10-17)	0.072
Abdominal by video	12.78 (4.21)	11.3 (9.7-16)	
Endoscopy	11.98 (3.34)	12 (9.7-13.8)	
Pediatric	11.93 (3.59)	12 (9-14)	
Plastic	11.87 (2.11)	12 (10-13.8)	
Thoracic	14 (2.37)	14 (11.8-16.3)	
Others	13.67 (4.2)	13.7 (10.5-16)	
Type of Anesthesia			
General Anesthesia	13.12 (4.07)	12.8 (10-16)	0.402
Neuroaxial blockade	13.21 (4.17)	13 (9.9-16)	
Combined	13.28 (3.39)	14 (10-15.3)	
Sedation	11.79 (3.36)	12.5 (9.5-13.7)	
Hypotension			
Yes	14.01 (4.37)	14 (11-17.2)	0.257
No	12.93 (3.95)	12.8 (10-15.4)	

Subtitle: SD – Standard Deviation. IQR – Interquartile Range. [a,b] Distinct subgroups at the 5% level for the Mann-Whitney-Holm test. SC – Surgical Center. ASA – American Society of Anesthesiologists.

Fasting times, when stratified into quartiles, revealed that those enduring fasts beyond 17 hours (n = 56) typically had protracted surgical interventions ($p = 0.038$). Other variables, when assessed against these intervals, did not manifest any perceptible variations, as tabulated in Table 3.

Correlation studies underscored a feeble association between surgery and anesthesia durations vis-à-vis fasting durations, corroborated by Pearson coefficients ($r1: 0.134$, $p < 0.05$; $r2: 0.121$, $p < 0.05$). Age, BMI, height, and weight remained uncorrelated with fasting times as per the Pearson coefficients.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 October 2023 doi:10.20944/preprints202310.0743.v1

Table 3. Distribution of fasting time intervals and clinical and demographic variables.

	Fasting (h)				
	<9h (n=39)	9-13 (n=109)	13-17 (n=89)	>17 (n=56)	p-value
SC . *n (%)*					
1	31 (12.4)	90 (36.1)	76 (30.5)	52 (20.9)	0.250 Q
2	8 (18.2)	19 (43.2)	13 (29.5)	4 (9.1)	
ASA. *n (%)*					
1	21 (15.6)	46 (34.1)	41 (30.4)	27 (20)	0.427 Q
2	17 (12.1)	51 (36.4)	43 (30.7)	29 (20.7)	
3	0 (0)	5 (71.4)	2 (28.6)	0 (0)	
4	0 (0)	2 (100)	0 (0)	0 (0)	
Gender. *n (%)*					
Female	25 (13.3)	72 (38.3)	55 (29.3)	36 (19.1)	0.964 Q
Male	14 (13.5)	37 (35.6)	33 (31.7)	20 (19.2)	
Age. *Median (IQR)*	37 (6-58.5)	39 (16.5-56.5)	39 (17-53.5)	41 (22.5-56.5)	0.591 K
Age group. *n (%)*					
1 to 9 years	12 (27.3)	16 (36.4)	14 (31.8)	2 (4.5)	0.051 Q
10 to 14 years	1 (4)	11 (44)	7 (28)	6 (24)	
15 to 24 years	3 (13)	4 (17.4)	8 (34.8)	8 (34.8)	
25 to 59 years	15 (10.3)	55 (37.9)	46 (31.7)	29 (20)	
from 60	8 (15.1)	21 (39.6)	13 (24.5)	11 (20.8)	
BMI (kg/m²). *Median (IQR)*	25.6 (20.4-28.2)	26.4 (23-30.5)	25.2 (21.8-29.8)	25.4 (23.1-28.3)	0.825 K
Height (m). *Median (IQR)*	160 (150-163)	159 (153-165)	158 (149-165)	159 (155.5-166)	0.565 K
Weight (kg). *Median (IQR)*	56.5 (22-68)	63.5 (47-74)	64 (48-76)	64.5 (55.5-80)	0.100 K
Round. *n (%)*					
Morning	11 (8.5) [a]	70 (54.3) [b]	45 (34.9) [a,b]	3 (2.3) [c]	<0.001 Q
Afternoon	28 (17.1) [a]	39 (23.8) [b]	44 (26.8) [a,b]	53 (32.3) [c]	
Anesthesia Time (h). *Median (IQR)*	1.5 (0.9-2.1)	1.8 (0.8-3.1)	1.8 (1.1-2.3)	2.3 (1.3-3)	0.070 K
Surgery Time (h). *Median (IQR)*	0.8 (0.5-1.3) [a]	1 (0.3-2.3) [b,c]	1 (0.5-1.8) [a,b]	1.7 (0.9-2.3) [c]	0.038 K
Type of Surgery. *n (%)*					
Open Abdominal	7 (13.2)	15 (28.3)	17 (32.1)	14 (26.4)	0.161 Q
Abdominal by video	6 (12.8)	22 (46.8)	8 (17)	11 (23.4)	
Endoscopy	3 (12)	12 (48)	8 (32)	2 (8)	
Pediatric	12 (21.8)	22 (40)	15 (27.3)	6 (10.9)	
Plastic	1 (8.3)	7 (58.3)	4 (33.3)	0 (0)	
Thoracic	0 (0)	2 (33.3)	3 (50)	1 (16.7)	
Others	10 (10.5)	29 (30.5)	34 (35.8)	22 (23.2)	
Type of Anesthesia. *n (%)*					
General Anesthesia	22 (13)	64 (37.9)	47 (27.8)	36 (21.3)	0.294 Q
Locks	12 (17.6)	20 (29.4)	21 (30.9)	15 (22.1)	
Combined	2 (9.5)	7 (33.3)	9 (42.9)	3 (14.3)	
Sedation	3 (8.6)	18 (51.4)	12 (34.3)	2 (5.7)	
Hypotension. *n (%)*					
Yes	1 (5.3)	8 (42.1)	4 (21.1)	6 (31.6)	0.349 Q
No	38 (13.9)	101 (36.9)	85 (31)	50 (18.2)	

IQR – Interquartile Range. K – Kruskal-Wallis test. [a,b] Distinct subgroups at the 5% level for the Mann-Whitney-Holm test. SC – Surgical Center. ASA – American Society of Anesthesiologists. BMI – Body Mass Index.

4. Discussion

The main findings of our investigation are as follows: 1) A significant deviation from the established preoperative fasting guidelines was noted, with only 10.6% of patients adhering to the recommended 8-hour fasting period; 2) More than half of the participants reported fasting durations exceeding 12 hours, translating to an average fasting time of 13 hours; 3) Surgeries scheduled in the afternoon were associated with an approximately 16% longer fasting time compared to those in the morning; and 4) The age group of 15-24 years exhibited the longest average fasting durations.

The latest guidelines, owing to the myriad advantages of shorter fasting periods, suggest that patients without underlying conditions that elevate aspiration risks should be allowed a clear carbohydrate-rich liquid solution up to two hours before elective surgeries. Meanwhile, the recommended fasting time for solid foods is established at six hours [6,14,15]. The preoperative protocol of the investigated hospital conforms to these guidelines. Nonetheless, our findings report an average fasting span of 13 hours, with a notable 53.2% of participants fasting over 12 hours. This clearly illustrates a departure from the intended clinical practice.

Parallel outcomes were presented by Aguilar-Nascimento et al. in their expansive study named BIGFAST, which included 3715 patients across 16 Brazilian healthcare institutions. Their research documented an average fasting time of 12 hours, with a concerning 46.2% of the participants exceeding a 12-hour fasting period. Notably, hospitals in this study were classified based on their fasting protocols. A significant majority, 75%, adhered to the traditional fasting protocol, which mandated a 6 to 8-hour fasting duration for both solids and liquids. The rest, termed as "modern fasting protocol," allowed clear liquid intake up until 2 hours pre-surgery. This distinction resulted in a remarkable 5-hour statistical difference in median fasting times between the groups (13 hours vs. 8 hours, $p < 0.001$). Notably, a mere 12.8% of the entire cohort adhered strictly to the recommended 6-hour maximum fasting time [16].

Zhi-Jian Sun, in 2022 [3], probed the adherence to the abbreviated fasting guideline in patients set for elective orthopedic surgeries. Despite adopting the ERAS protocol's preoperative fasting recommendations three years prior, and explicit instructions for 306 participants to consume a 400 mL 12.5% maltodextrin solution 2 hours before surgery, 25.2% abstained. This resulted in a significant difference in the median fasting times for clear liquids between compliant and non-compliant groups (6.8 hours vs. 15 hours, $p < 0.0001$). The overall recorded fasting averages were 8 hours for liquids and 19 hours for solids. The results showed an overall average fasting time of eight hours for liquids and 19 hours for solid foods [3].

UK-based research with 266 participants documented fasting times averaging 15.6 hours for solids and 4.9 hours for liquids. Worryingly, while 77% fasted between 12 to 24 hours, 6% exceeded 24 hours. Despite receiving written instructions, there was an evident knowledge gap, with only about 71-72% being aware of the prescribed fasting durations [18]. Although our study did not differentiate between fasting time for solids and liquids, 3.7% of participants fasted for more than 20 hours, and only one patient fasted for over 24 hours. Even institutions that have transitioned to modern fasting protocols, as is the case with our study's hospital, still record average fasting times exceeding the recommendations. This underscores the real-world challenges in translating guidelines into routine practice.

In a noteworthy 2022 update [6], the European Society of Anesthesiology revised its pediatric preoperative fasting guidelines. These now advocate for a reduced fasting duration for clear caloric solutions to one hour before procedures. No significant variations were reported in pulmonary aspiration incidence and gastric emptying times compared to conventional fasting. Positive patient outcomes, including diminished thirst, hunger, anxiety, crying, and postoperative nausea and vomiting, were accentuated. The study also explored whether pediatric patients with obesity or type 1 diabetes mellitus required modified fasting protocols. They concluded in the negative, affirming that elongated fasting wouldn't lower pulmonary aspiration risks. Additionally, the guidelines spotlighted the potential role of ultrasound in gauging gastric contents in pediatric patients who might not comply with the standard preoperative fasting recommendations [6].

In 2023, the American Society of Anesthesiologists (ASA) endorsed the 2017 ASA guidelines, recommending clear liquids be consumed up to 2 hours preoperatively. Liquids like water, black coffee, black tea, and pulp-free juice can be ingested safely until 2 hours before procedures necessitating general anesthesia, regional anesthesia, or procedural sedation. The 2023 update emphasizes that healthy adults should consume carbohydrate-rich clear liquids, either simple or complex, up to 400mL, 2 hours before elective procedures under anesthesia or sedation. Additionally,

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 October 2023 doi:10.20944/preprints202310.0743.v1

the guidance suggests not postponing elective procedures in healthy adults who chew gum. To minimize prolonged fasting in children, efforts must be directed to permit clear liquids for those at a low aspiration risk, as close to the 2-hour pre-procedure mark as feasible [14].

A 2020 German study evaluated the preoperative fasting durations in over 10,000 pediatric patients set for elective procedures. It reported an average fasting time of 9.3 hours for light meals and 2.3 hours for liquids. Participants were categorized into three segments based on their clear liquid fasting durations: 1-2 hours (n = 2,897), 2-4 hours (n = 2,995), and > 4 hours (n = 4,492). The study documented 31 instances of gastric regurgitation, 10 suspected pulmonary aspirations, and 4 confirmed cases. Statistically, no significant distinction emerged among the groups. Yet, in patients with less than 1 hour of clear liquid fasting (n = 1,708), a higher prevalence of complications was observed. Factors such as ASA status, anesthesia induction techniques, and surgery types weren't linked with increased adverse effects. However, children aged 1-3 years were pinpointed as a risk (odds ratio 2.7) [7].

In our investigation involving 69 pediatric patients (up to 15 years), the mean fasting duration was 12.55 hours. Remarkably, 11.6% fasted over 17 hours. A 2022 retrospective study from China resonated with these findings, reporting average fasting periods of 13 hours for solids and 12 hours for liquids in 151 pediatric patients undergoing non-gastrointestinal surgeries and adhering to traditional fasting guidelines. With the introduction of the ERAS protocol, fasting durations in a subsequent group (n = 152) notably decreased to 11.92 hours for solids and 3 hours for liquids. These children were advised to take up to 5 mL/kg of clear fluids, capping at 300 mL, just 2 hours before their surgeries. This research ensured regular surveillance of surgical schedules, pinpointing and mitigating potential delays to avert extended fasting. The authors accentuated the paramountcy of not just introducing a revised fasting protocol, but also the thorough training of the medical staff to adeptly apply it, especially given the frequent surgical rescheduling [4].

Carvalho et al. sought to assess the metabolic and inflammatory advantages of abbreviated fasting through a prospective, randomized-controlled study. This involved pediatric patients, aged 2 to 6 years, undergoing elective unilateral or bilateral herniorrhaphy. The protocol involved administering 150 mL of 12.5% maltodextrin solution two hours before the surgery. Inhalation anesthetics were used for induction in all patients. The fasting period for the intervention group (n = 21) was 2.49 hours, contrasting with the control group's (n = 19) 11.24 hours ($p < 0.001$). The group receiving the caloric solution displayed decreased levels of C-reactive protein in both preoperative (0.59 vs 3.60, $p = 0.05$) and postoperative (0.49 vs 3.53, $p = 0.02$) phases, lower CRP/albumin ratios (0.13 vs 0.89, $p = 0.03$), and reduced hyperglycemia instances (0% vs 21%, $p = 0.04$). Insulin resistance was ascertained using the HOMA-IR index formula: [Fasting glucose (mg/dl) x 0.0555 x Insulin (nU/ml)] / 22.5. Notably, statistical differences between the groups remained elusive. Consequently, while extended fasting doesn't mitigate pulmonary aspiration risks and might foster reduced inflammation and enhance pediatric patient well-being, its practice persists in hospitals [10].

Numerous randomized trials have explored the implications of diminished fasting on inflammatory markers (e.g., IL-6, CRP, cortisol), insulin resistance, gastrointestinal functional recovery, and hospital stay durations [5,8,9,11]. Zhang and Min conducted a clinical trial with two groups of 29 participants each. Those in the control group underwent preoperative fasting from midnight on the day before surgery, while patients in the intervention group received a clear carbohydrate solution 2 hours before the procedure. They demonstrated that the introduction of 400 mL of 12.5% carbohydrate solution reduced the length of hospital stay (4.36 vs 3.82 days, $p=0.0079$), time to flatus appearance (39.29 vs 28.89 hours, $p=0.0071$), levels of IL-6 (60.86 vs 74.28, $p<0.001$), CRP (11.46 vs 10.64, $p<0.001$), and cortisol (1.90 vs 1.75, $p<0.001$). It also improved patient comfort by reducing thirst, hunger, and anxiety ($p<0.001$) compared to fasting from midnight. However, the study did not find a difference in the incidence of postoperative nausea and vomiting [13].

Historically, preoperative fasting was advocated to guarantee gastric emptying, thereby minimizing the risk of pulmonary aspiration during anesthesia induction. However, contemporary research suggests that administering a caloric liquid solution two hours before surgery insignificantly affects gastric volume and pH, given the 90-minute half-life of gastric contents, which calls into

 doi:10.20944/preprints202310.0743.v1

question the need for extended fasting. Cho et al. [20] embarked on a prospective, double-blinded, randomized placebo-controlled study involving sixty-four female patients awaiting elective laparoscopic benign gynecologic procedures. Participants were bifurcated: one cohort observed a 12-hour preoperative fasting regimen for liquids, while the counterpart consumed 400 mL of 12.8% maltodextrin solution at midnight preceding surgery and an hourly intake of 100-200 mL, ceasing 2 hours before the procedure. Ultrasonographic assessments of gastric volume (70 vs 66 mL, $p = 0.756$) and cross-sectional area (6.25 vs 6.21 cm^2, $p = 0.959$) were overseen by two anesthesiologists and subsequently vetted by a proficient radiologist; revealing no statistical variance between cohorts. Solid food fasting duration averaged 15 hours for both groups. However, liquid fasting spanned 12 hours in the NPO group compared to the 2-hour window in the NO-NPO group [20]. The introduction of the caloric solution didn't elevate gastric content aspiration risks, even amidst patients with predispositions such as diabetes or pregnancy [5,12].

In a separate investigation, Xue Li et al. [5] executed an observer-blinded, randomized controlled trial targeting patients diagnosed with Type 2 Diabetes Mellitus set for gastrointestinal surgeries exceeding 2 hours in duration. The control group adhered to the conventional hospital fasting protocol: the final solid meal was ingested by 10 p.m. the previous evening, and water consumption was allowed until 6 a.m. on the surgery day. If procedures were slated post-noon, a 5% glucose intravenous infusion was administered. Conversely, the second group was provided a 14.2% carbohydrate clear liquid solution at stipulated times, with a moratorium on other liquid intake, and given a subcutaneous dose of insulin aspart preceding the solution consumption. Beyond the absence of pulmonary aspiration episodes, the carbohydrate solution cohort manifested reduced postoperative nausea and vomiting (9.7% vs. 31.3%, $p = 0.034$), diminished intraoperative hypotension events (16.1% vs. 40.6%, $p = 0.031$), and lessened discomfort indicators like thirst, hunger (both $p < 0.001$), and fatigue ($p = 0.004$) [5]. Such findings, coupled with others, underscore the redundant safety purportedly offered by elongated fasting in averting pulmonary aspiration [12,21,22].

Afternoon surgeries were observed to have longer average fasting durations than those scheduled in the morning (13.84 vs. 11.92 hours, $p < 0.001$). Similarly, El-Sharkawy et al., in an observational study of 343 participants, found afternoon surgeries extended fasting times relative to morning ones (16.6 vs. 15.3 hours, $p = 0.07$). Our findings align with theirs: age, sex, BMI, surgery type, and anesthesia type were not significantly tied to fasting duration [18]. The BIGFAST study analyzed 3,715 patients, finding no significant fasting time differences related to sex, nutrition status, ASA classification, or age. Yet, when categorizing patients by disease etiology - benign (75.35%) vs. cancer-related (32.65%) - a notable fasting time difference emerged ($p < 0.001$) [16].

A 2020 survey of 971 anesthesiologists across multiple countries revealed that 50.4% still advocated midnight fasting for both solids and liquids. Surgical schedule unpredictability was frequently cited as a reason for guideline non-adherence [17]. The EXPERIENCE study highlighted patient diversity and inter-professional communication gaps as additional causes of guideline non-adherence [19]. A systematic review analyzing preoperative fasting recommendations available on the internet concluded that 55% of the 87 websites analyzed provided at least one piece of information contradicting the established guidelines, even though 53% of the sites were from healthcare institutions [23]. Misunderstandings of healthcare professional instructions were common. In a study with 270 patients, those reminded via text message to fast showed a shorter average liquid fasting time (3.5 vs. 6.5 hours, $p < 0.0001$), but solid food fasting remained unchanged. Some patients' reluctance to eat late also potentially influenced fasting periods [24]. Some patients' reluctance to eat late also potentially influenced fasting periods [4,18,25].

The present study, while offering valuable insights into fasting behaviors, does have certain limitations. Firstly, the research utilized convenience sampling, which might not encompass the breadth of random sampling. However, this method still allowed us to explore patterns within the selected sample, offering meaningful preliminary data that aligns with prior studies. Moreover, our findings' consistency suggests the generalizability of our insights and provides foundational knowledge for further studies using varied sampling techniques. The initiation of the fasting period was self-reported by patients, potentially introducing minor imprecisions. Yet, patient self-reporting is a standard practice in many medical studies, especially when direct observation is impractical. It's important to recognize that participants likely reported their fasting durations with honesty, given they had no discernible motive to intentionally misreport. While we did not distinguish between fasting times for solid foods and liquids, our primary aim was to capture an overarching understanding of fasting behaviors. Such an aggregate perspective provides a broader outlook before delving into nuanced details, which could be the focus of subsequent research. The study did not classify patients based on comorbidities that may influence aspiration risk. Nevertheless, our objective was to ascertain general fasting durations, with the recognition that individualized risks, like specific comorbidities, can be addressed in specialized, future studies. Furthermore, we didn't investigate potential reasons for prolonged fasting. This choice was strategic; having identified this pattern, we've highlighted the need for further research to unpack these underlying causes.

5. Conclusion

Despite the existence of an international consensus on preoperative fasting durations, our findings depict a substantial departure from these recommendations. An overwhelming 89.4% of the study participants fasted for an average duration of 13 hours, significantly surpassing the recommended guidelines. Regardless of age brackets, the average fasting span surpassed 11 hours. This discrepancy was particularly evident for patients with afternoon surgery schedules. There is a compelling need for healthcare professionals to enhance their understanding of contemporary fasting guidelines and prioritize comprehensive patient and healthcare team education. Future research endeavors should probe into devising effective strategies to mitigate prolonged fasting episodes.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Research Board (Certificate number: 13354118.2.0000.5546) from the Federal University of Sergipe, Brazil.

Informed Consent Statement: Informed consent was obtained from all subjects.

Data Availability Statement: Data is contained within the article.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Snow, J.D. ON THE INHALATION OF THE VAPOUR OF ETHER IN SURGICAL OPERATIONS. *Br. J. Anaesth.* 1953, *25*, 253–267, doi:10.1093/bja/25.3.253.
2. Mendelson, C.L. The Aspiration of Stomach Contents into the Lungs During Obstetric Anesthesia. *Am. J. Obstet. Gynecol.* 1946, *52*, 191–205, doi:10.1016/S0002-9378(16)39829-5.
3. Sun, Z.; Sun, X.; Huo, Y.; Mi, M.; Peng, G.; Zhang, C.; Jiang, Y.; Zhou, Y.; Zhao, X.; Li, T.; et al. Abbreviated Perioperative Fasting Management for Elective Fresh Fracture Surgery: Guideline Adherence Analysis. *BMC Musculoskelet. Disord.* 2022, *23*, 688, doi:10.1186/s12891-022-05574-5.
4. Ying, Y.; Xu, H.-Z.; Han, M.-L. Enhanced Recovery after Surgery Strategy to Shorten Perioperative Fasting in Children Undergoing Non-Gastrointestinal Surgery: A Prospective Study. *World J. Clin. Cases* 2022, *10*.
5. Li, X.; Liu, L.; Liang, X.-Q.; Li, Y.-T.; Wang, D.-X. Preoperative Carbohydrate Loading with Individualized Supplemental Insulin in Diabetic Patients Undergoing Gastrointestinal Surgery: A Randomized Trial. *Int. J. Surg.* 2022, *98*, 106215, doi:10.1016/j.ijsu.2021.106215.
6. Frykholm, P.; Disma, N.; Andersson, H.; Beck, C.; Bouvet, L.; Cercueil, E.; Elliott, E.; Hofmann, J.; Isserman, R.; Klaucane, A.; et al. Pre-Operative Fasting in Children: A Guideline from the European Society of Anaesthesiology and Intensive Care. *Eur. J. Anaesthesiol.* 2022, *39*, 4–25, doi:10.1097/EJA.0000000000001599.
7. Beck, C.E.; Rudolph, D.; Mahn, C.; Etspüler, A.; Korf, M.; Lüthke, M.; Schindler, E.; Päukert, S.; Trapp, A.; Megens, J.H.A.M.; et al. Impact of Clear Fluid Fasting on Pulmonary Aspiration in Children Undergoing General Anesthesia: Results of the German Prospective Multicenter Observational (NiKs) Study. *Pediatr. Anesth.* 2020, *30*, 892–899, doi:10.1111/pan.13948.

8. Fearon, K.C.H.; Ljungqvist, O.; Von Meyenfeldt, M.; Revhaug, A.; Dejong, C.H.C.; Lassen, K.; Nygren, J.; Hausel, J.; Soop, M.; Andersen, J.; et al. Enhanced Recovery after Surgery: A Consensus Review of Clinical Care for Patients Undergoing Colonic Resection. *Clin. Nutr.* 2005, *24*, 466–477, doi:10.1016/j.clnu.2005.02.002.
9. Rizvanović, N.; Nesek Adam, V.; Čaušević, S.; Dervišević, S.; Delibegović, S. A Randomised Controlled Study of Preoperative Oral Carbohydrate Loading versus Fasting in Patients Undergoing Colorectal Surgery. *Int. J. Colorectal Dis.* 2019, *34*, 1551–1561, doi:10.1007/s00384-019-03349-4.
10. Carvalho, C.A.L. de B.; Carvalho, A.A. de; Preza, A.D.G.; Nogueira, P.L.B.; Mendes, K.B.V.; Dock-Nascimento, D.B.; Aguilar-Nascimento, J.E. Benefícios Metabólicos e Inflamatórios Da Abreviação Do Jejum Pré-Operatório Em Cirurgia Pediátrica. *Rev. Colégio Bras. Cir.* 2020, *47*, e20202353, doi:10.1590/0100-6991e-20202353.
11. Akbuğa, G.A.; Başer, M. Effect of Preoperative Oral Liquid Carbohydrate Intake on Blood Glucose, Fasting-Thirst, and Fatigue Levels: A Randomized Controlled Study. *Braz. J. Anesthesiol. Engl. Ed.* 2021, S0104001421001329, doi:10.1016/j.bjane.2021.02.053.
12. Shi, Y.; Dong, B.; Dong, Q.; Zhao, Z.; Yu, Y. Effect of Preoperative Oral Carbohydrate Administration on Patients Undergoing Cesarean Section with Epidural Anesthesia: A Pilot Study. *J. Perianesth. Nurs.* 2021, *36*, 30–35, doi:10.1016/j.jopan.2020.05.006.
13. Zhang, Y.; Min, J. Preoperative Carbohydrate Loading in Gynecological Patients Undergoing Combined Spinal and Epidural Anesthesia. *J. Invest. Surg.* 2020, *33*, 587–595, doi:10.1080/08941939.2018.1546352.
14. Joshi, G.P.; Abdelmalak, B.B.; Weigel, W.A.; Harbell, M.W.; Kuo, C.I.; Soriano, S.G.; Stricker, P.A.; Tipton, T.; Grant, M.D.; Marbella, A.M.; et al. 2023 American Society of Anesthesiologists Practice Guidelines for Preoperative Fasting: Carbohydrate-Containing Clear Liquids with or without Protein, Chewing Gum, and Pediatric Fasting Duration—A Modular Update of the 2017 American Society of Anesthesiologists Practice Guidelines for Preoperative Fasting. *Anesthesiology* 2023, *138*, 132–151, doi:10.1097/ALN.0000000000004381.
15. de-Aguilar-Nascimento, J.E.; Salomão, A.B.; Waitzberg, D.L.; Dock-Nascimento, D.B.; Correa, M.I.T.D.; Campos, A.C.L.; Corsi, P.R.; Portari Filho, P.E.; Caporossi, C. ACERTO Guidelines of Perioperative Nutritional Interventions in Elective General Surgery. *Rev. Colégio Bras. Cir.* 2017, *44*, 633–648, doi:10.1590/0100-69912017006003.
16. Aguilar-Nascimento, J.; Dias, A.; Dock-Nascimento, D.; Correia, M.; Campos, A.; Portari-Filho, P.; Oliveira, S. Actual Preoperative Fasting Time in Brazilian Hospitals: The BIGFAST Multicenter Study. *Ther. Clin. Risk Manag.* 2014, 107, doi:10.2147/TCRM.S56255.
17. Merchant, R.N.; Chima, N.; Ljungqvist, O.; Kok, J.N.J. Preoperative Fasting Practices Across Three Anesthesia Societies: Survey of Practitioners. *JMIR Perioper. Med.* 2020, *3*, e15905, doi:10.2196/15905.
18. El-Sharkawy, A.M.; Daliya, P.; Lewis-Lloyd, C.; Adiamah, A.; Malcolm, F.L.; Boyd-Carson, H.; Couch, D.; Herrod, P.J.J.; Hossain, T.; Couch, J.; et al. Fasting and Surgery Timing (FaST) Audit. *Clin. Nutr.* 2021, *40*, 1405–1412, doi:10.1016/j.clnu.2020.08.033.
19. Byrnes, A.; Young, A.; Mudge, A.; Banks, M.; Bauer, J. EXploring Practice Gaps to Improve PERIoperativE Nutrition CarE (EXPERIENCE Study): A Qualitative Analysis of Barriers to Implementation of Evidence-Based Practice Guidelines. *Eur. J. Clin. Nutr.* 2019, *73*, 94–101, doi:10.1038/s41430-018-0276-x.
20. Cho, E.-A.; Huh, J.; Lee, S.H.; Ryu, K.-H.; Shim, J.-G.; Cha, Y.-B.; Kim, M.S.; Song, T. Gastric Ultrasound Assessing Gastric Emptying of Preoperative Carbohydrate Drinks: A Randomized Controlled Noninferiority Study. *Anesth. Analg.* 2021, *133*, 690–697, doi:10.1213/ANE.0000000000005411.
21. Jeong, J.Y.; Ahn, J.H.; Shim, J.-G.; Lee, S.H.; Ryu, K.-H.; Lee, S.-H.; Cho, E.-A. Gastric Emptying of Preoperative Carbohydrate in Elderly Assessed Using Gastric Ultrasonography: A Randomized Controlled Study. *Medicine (Baltimore)* 2021, *100*, e27242, doi:10.1097/MD.0000000000027242.
22. Bisinotto, F.M.B.; Silveira, L.A.M. da; Rossi, T.C.; Martins, L.B.; Zago, G.P.; Mendonça, M.A.L. Estudo comparativo do esvaziamento gástrico entre uma solução isotônica e um suplemento nutricional por meio da ultrassonografia. *Braz. J. Anesthesiol.* 2019, *69*, 115–121, doi:10.1016/j.bjan.2018.09.006.
23. Roughead, T.; Sewell, D.; Ryerson, C.J.; Fisher, J.H.; Flexman, A.M. Internet-Based Resources Frequently Provide Inaccurate and Out-of-Date Recommendations on Preoperative Fasting: A Systematic Review. *Anesth. Analg.* 2016, *123*, 1463–1468, doi:10.1213/ANE.0000000000001590.
24. Zia, F.; Cosic, L.; Wong, A.; Levin, A.; Lu, P.; Mitchell, C.; Shaw, M.; Rosewarne, F.; Weinberg, L. Effects of a Short Message Service (SMS) by Cellular Phone to Improve Compliance with Fasting Guidelines in

 doi:10.20944/preprints202310.0743.v1

Patients Undergoing Elective Surgery: A Retrospective Observational Study. *BMC Health Serv. Res.* 2021, *21*, 27, doi:10.1186/s12913-020-06039-y.

25. van Noort, H.H.J.; Eskes, A.M.; Vermeulen, H.; Besselink, M.G.; Moeling, M.; Ubbink, D.T.; Huisman–de Waal, G.; Witteman, B.J.M. Fasting Habits over a 10-Year Period: An Observational Study on Adherence to Preoperative Fasting and Postoperative Restoration of Oral Intake in 2 Dutch Hospitals. *Surgery* 2021, *170*, 532–540, doi:10.1016/j.surg.2021.01.037.