Journal of PeriAnesthesia Nursing 36 (2021) 167–173

Contents lists available at ScienceDirect

Journal of PeriAnesthesia Nursing

journal homepage: www.jopan.org

Research

The Effects of Preoperative Fasting on Patients Undergoing Thoracic Surgery

Meryem Yilmaz, PhD [a,*], Meltem Çelik, MSc, RN [b]

[a] Nursing Division, Department of Surgical Nursing, Faculty of Health Sciences, Sivas Cumhuriyet University, Sivas, Turkey
[b] Thoracic Surgery Department, Sivas Cumhuriyet University, Sivas, Turkey

Keywords:
thoracic surgery
fasting
preoperative fasting
aspiration
thirst

ABSTRACT

Purpose: The purpose of this study was to determine the effects of fasting before surgery on patients undergoing thoracic surgery.
Design: This descriptive cross-sectional study was conducted from January 1 to June 30, 2017.
Methods: The study was carried out with 85 patients who underwent thoracotomy, mediastinoscopy, or rib resection in the thoracic surgery department of a university hospital. All patients started fasting midnight before day of surgery. Data were collected using a questionnaire, Visual Analog Patient Satisfaction Scale, and preoperative laboratory findings form.
Findings: The mean fasting hours of solids and clear fluids were 8 and 16, respectively, and the mean duration of preoperative fasting (POF) was 10.16 (SD = 1.67), total fasting time average was 28.09 (SD = 7.11). Total protein and albumin levels decreased, and glucose level increased after surgery. The difference between total protein, albumin, and glucose levels preoperatively and postoperatively was significant ($P < .05$). The difference between patient satisfaction and thirst was found to be statistically significant ($P < .05$). A positive correlation was found between POF and thirst ($r = 0.450$; $P = .000$), hunger ($r = 0.402$; $P = .000$), total protein ($r = 0.508$; $P = .000$), albumin ($r = 0.537$; $P = .000$), and glucose levels ($r = 0.371$; $P = .000$).
Conclusions: POF had an adverse effect on thirst, hunger, and total protein as well as albumin and glucose levels.

Traditionally, preoperative fasting (POF), also known as nothing by mouth, is defined as the restriction of oral liquid and solid intakes beginning the previous midnight before an elective surgical procedure requiring anesthesia and postoperatively until recovery of bowel function.[1,2] The approach was initially reported by Mendelson,[3] the American obstetrician who came up with the idea in 1946 for pregnant women to prevent the aspiration of stomach contents into the lungs during obstetric anesthesia.[4] He observed death cases related to aspiration of solid stomach content in operations with general anesthetic induction in pregnant women, and therefore, he asserted the necessity of the empty stomach during delivery. He also recommended that nothing by mouth be implemented starting the midnight before the operation.[3]

Subsequently, this procedure was generalized to nonobstetric surgery, and POF became the main strategy to prevent pulmonary aspiration of gastric contents in patients undergoing elective surgery, requiring anesthesia. POF has become a routine practice for anesthesiologists to ensure patient safety.[5] During anesthesia, such protective reflexes, as gagging, coughing, and swallowing, are suppressed, and hence, stomach contents can be aspirated. Although anesthesia is generally safe, respiratory complications, such as anesthesia-related aspiration, still remain the most significant causes of airway-related mortality.[6] The incidence of aspiration in elective surgery is 1 per 2,000 to 3,000 during anesthesias in adults, depending on certain risk factors.[7] Thus, patients must endure a restricted intake of all solid foods and liquids for at least 8 to 12 hours before anesthesia. In the first POF guidelines published by Joseph Lister in 1883, when chloroform was used as an anesthetic, it was desirable to have no solids in the stomach, although a

Conflict of interest: None to report.
Financial disclosure:The authors declare that this study received no financial support.
* Address correspondence to Meryem Yilmaz, Nursing Division, Department of Surgical Nursing, Faculty of Health Sciences, Sivas Cumhuriyet University, 58140 Sivas, Turkey.
E-mail address: yilmazmm01@hotmail.com (M. Yilmaz).

https://doi.org/10.1016/j.jopan.2020.08.011
1089-9472/

cup of tea 2 hours before anesthesia was recommended.[8] Much later, in 1999 and 2011, the American Society of Anesthesiologists (ASA)[9,10] recommended that general or nonpregnant patients should not have solids 6 hours and clear fluids for at least 2 hours before surgical procedures involving anesthesia. However, because of aspiration fears, patients are reportedly fasting more than necessary.[11,12]

Several factors seem to contribute to prolonged POF: (1) lack of individualized POF instructions regarding the fasting period before a surgery and solid or fluid intake, taking the patient's condition into consideration; (2) the inevitable delays because of the unpredictable nature of the operating room (OR), such as complications or emergencies that occur during surgery; (3) the lack of knowledge about fasting guidelines among the clinical team; and (4) workload.[1,5,13] In addition to those factors, planned operations can be canceled, or surgery in the morning can be delayed until the afternoon, so patients' POF time becomes longer than expected. In some instances, certain conditions may even necessitate rescheduling and another round of POF.[8] Consequently, many studies have emphasized the harmful effects of prolonged fasting, but patients continue to be deprived of food and fluid for an excessively long period.

Prolonged POF may cause physiological effects, such as osmotic and hypovolemic thirst,[14] hunger, dehydration,[15] electrolyte imbalance,[11,12] and increased incidence of postoperative nausea and vomiting,[16-18] and metabolic effects, such as hypoglycemia, increased insulin resistance,[18,19] and increased stress responses to surgery.[15] In addition, several psychosocial effects are also common, including irritability, discomfort, headache,[15] as well as anxiety[5,16,20] during the preoperative and postoperative periods. Furthermore, POF prolongation may delay patient recovery and discharge from hospital,[13] adversely affecting patient satisfaction.[1,18]

Therefore, according to ASA guidelines, prolonged POF is an unnecessary and harmful process for healthy individuals, who do not have additional health problems (eg, comorbid diseases, gastroesophageal reflux disease, dysphagia symptoms, or other gastrointestinal motility disorders, metabolic disorders such as diabetes mellitus) for elective surgery.[8] The following fasting rules are recommended for all healthy adults undergoing elective surgery, the so-called 6-4-2 rule[2]; 6 hours for solids, 4 hours for breast milk, and 2 hours for clear fluids (water, carbonated drinks, clear tea, black coffee, and pulp-free juices). These rules are similarly recommended by the European Society of Thoracic Surgeons for patients undergoing thoracic surgery.[21] These rules are based on the physiology of gastric emptying, the rate of which is a measure of the emptying rate of the solid and liquid into the duodenum regulated by the physical and chemical natures of the food through neurohormonal control mechanisms. Several factors influence gastric emptying. One of these factors is the timing and rate of emptying of food, the quantity and different physical compositions of the chyme that reaches the duodenum, and the other is the calorie density of food. For example, water may leave the stomach promptly. Liquids and solids are emptied in the digestive period that lasts 2 to 3 hours after a meal.[22]

For thoracic surgery, POF from the midnight before surgery has been largely used in the past and is still used in many thoracic surgery units to reduce the risk of bronchial inhalation during general anesthesia and immediately after surgery.[23] Despite the advantages of the globally acceptable guidelines, most hospitals in Turkey still maintain the practice of the time-honored standard nothing by mouth from midnight fasting policy. Its main objective is to minimize the risk of pulmonary aspiration of gastric contents during anesthesia. This POF policy also has been perceived as easy to administer and enable alterations in the OR list. The aim of this study is to identify the effects of POF and fasting times on patients undergoing a thoracic surgery at a university hospital in Turkey.

The questions of our study were as follows:

1. What are POF and total fasting periods for patients undergoing thoracic surgery?
2. What are Visual Analog Patient Satisfaction Scale (VAPSS) scores of total fasting times for patients?
3. What problems do patients undergoing thoracic surgery experience with fasting?

Methods

Design

A descriptive cross-sectional design was used.

Setting and Participants

This single-center study was conducted from January 1 to June 30, 2017, in the thoracic surgery department of the Sivas Cumhuriyet University Hospital, in the Central Anatolia region of Turkey. The department has 16 beds, three physicians, and five nurses. Patients are usually fasted from 24:00 onward.

The study population included nonrandomized 85 adult patients (26 females and 59 males) who met the inclusion criteria: (1) aged 18 years and older; (2) physical status ASA I or II; (3) scheduled for elective surgery under general anesthesia; (4) able to consent to participate in the study; and (5) were scheduled for elective surgery in the thoracic surgery clinic, under general anesthesia. Those with a history of diabetes mellitus were excluded from the study.

Data Collection

Data were collected using three approaches: questionnaires; VAPSS; and laboratory data.

Questionnaire

Based on the relevant literature,[1,2,8,11,19] a self-administered structured questionnaire developed by the researchers and validated by three experts in the field of surgical nursing was used. The questionnaire form included two sections. Section 1 includes demographic data (eg, age, gender, education level), and section 2 covers preoperative and postoperative fasting-related characteristics (eg, POF start time, compliance with POF times, knowing the reason for POF, information about fasting and difficulties with POF).

Visual Analog Patient Satisfaction Scale

The VAPSS was developed by Kılınçer and Zileli.[24] The scale includes a vertical line accompanied by two faces at its inferior and superior ends, representing complete dissatisfaction and full satisfaction. The patient signs the point on the line, which matches his and/or her level of satisfaction with the medical care. The scoring is made between 0 and 10. The VAPSS takes advantage of two validated and commonly used scales (Visual Analog Pain Scale and Wong-Baker Scale). It is an easy-to-understand and practical scoring tool that can be applied to patients of every age and educational level. It has been used to assess preoperative and postoperative thirst, hunger, and headache levels and ranged from 0 to 10. Severity is directly related to a numerical indicator; for example, 0 refers to never thirsty and 10 refers to very thirsty. Patients marked their thirst, hunger, and headache levels on the scale (Figure 1).

Laboratory Findings

Patient laboratory data (total protein, albumin, and plasma glucose levels) were recorded in the preoperative and postoperative periods.

Ethical Considerations

Approval (2014-12/07) was obtained from Noninvasive Clinical Trials Ethics Committee of Cumhuriyet University where the study was conducted, and permission was taken from the institution where the data were collected. The study was performed in accordance with the Declaration of Helsinki. Before the study, both oral and written informed consent was obtained from all the participants. Patients will also be kept confidential of the individual information obtained and have been informed on their right to withdraw from the study at any time, without justification.

Procedures

Patients were instructed to fast from midnight (24.00). Before study participation, patients were informed about the research, and their written and verbal consent obtained. Later, questionnaires were given to patients in the afternoon of the day of hospitalization. Just before the operation, fasting, thirst, and headache levels were determined using VAPSS. After the operation, patients were assessed again using VAPSS, before oral administration of anything (including ice chips or water) or juice or food. The total fasting time for patients was taken as the sum of the time before surgery, the time spent in surgery, and the time until postoperative eating. Total protein, albumin, and plasma glucose levels were determined the day before surgery, as part of routine preoperative laboratory tests, and after surgery, but before starting oral administration. In the laboratory of the institution where this study is conducted, fasting plasma glucose is indicated normal (ranged from 70 to 99 mg/dL) and high (100 mg/dL and greater). The normal range for total protein levels in blood plasma is 6 to 8 g per deciliter (g/dL). Of this, albumin makes up 3.5 to 5.0 g/dL. Fasting means after not having anything to eat or drink (except water) for at least 8 hours before the test. Therefore, fasting hyperglycemia, total proteins, and albumin levels were evaluated according to these threshold values. Data were collected using face-to-face interviews.

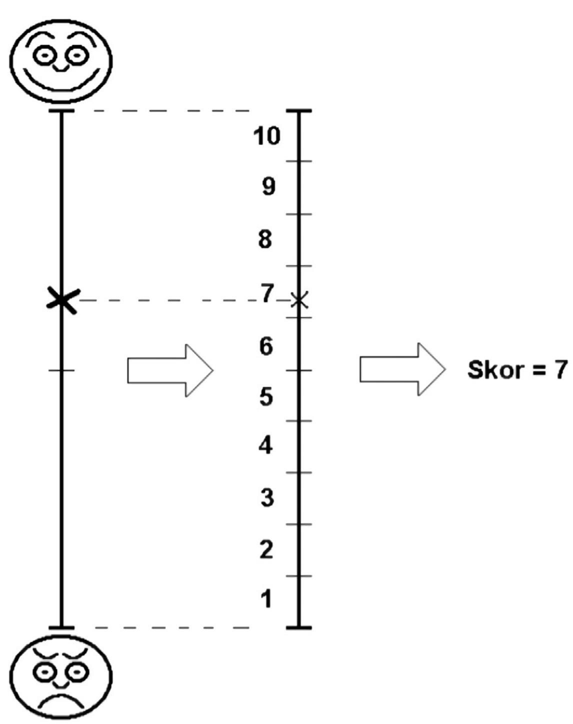

Figure 1. Visual Analog Patient Satisfaction Scale.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (version 19.0; SPSS, Inc, Chicago, IL). In this study, the effect size (effect size and difference) was estimated at 0.36. If 85 patients participated at a 5% significance level, the test power was $1 - \beta = 0.9506841$ (95%). The normality of the data was calculated by the Kolmogorov-Smirnov test. Quantitative data were represented as descriptive statistics (ie, means and SDs for continuous data as well as frequency and counts) and were reported as appropriate. Independent-sample *t* test and analysis of variance (ANOVA) analyses were used to compare preoperative and postoperative total protein, albumin, and plasma glucose levels and also thirst, hunger, headache, and VAPSS mean scores. Statistical significance was reported at $P < .05$.

Results

A total of 85 patients participated in this study, and the mean age was 53.95 years; 69.4% were males, and most had a low educational level (92.9%). A large majority (72.9%) of patients had a thoracotomy, and 25.9% of patients had a POF time of ≥11 hours. Most (96.5%) of the patients started fasting the midnight before surgery day, and 98.8% were compliant with fasting, 78.8% were informed about POF, and 69.4% experienced thirst. Patients fasted on average for 10.16 hours (SD = 1.67) before surgery and 3.14 hours (SD = 3.07) postsurgery. Of these, 58.8% fasted for 9 hours or more postsurgery, and a total of 50.6% of patients fasted for 16 to 28 hours and 49.4% for 29 to 47 hours. The average fasting time was 28.09 hours (minimum = 16 and maximum = 47; Table 1).

As shown in Table 2, total protein and albumin levels of the patients decreased postoperatively, but glucose levels increased. A statistically significant difference was observed between plasma glucose levels of patients at preoperative and postoperative periods ($P < .001$). Patients younger than 40 years had higher total protein and albumin levels, during the preoperative and postoperative periods, when compared with patients older than 40 years, and the difference between albumin levels was statistically significant ($P < .05$). But, patients younger than 40 years had lower plasma glucose levels within the preoperative and postoperative periods than those of the patients older than 40 years, but there was no statistically significant difference between plasma glucose levels ($P > .05$).

The total protein, albumin, and plasma glucose levels in male patients were higher than those of the female patients, but the difference was not statistically significant ($P > .05$). Patients with a higher education had higher preoperative and postoperative total protein and albumin levels and patients with low education had higher preoperative plasma glucose levels. There was a statistically significant difference between the albumin levels ($P < .05$). Patients younger than 40 years had higher thirst and hunger scores preoperatively and postoperatively, when compared with patients older than 40 years, but they did not experience preoperative headaches; on the other hand, patients older than 40 years experienced headaches preoperatively and postoperatively. Statistically significant differences were observed between age and preoperative headaches ($P > .05$), but there were no statistically significant differences between postoperative thirst, hunger, and headache scores ($P > .05$). The thirst and hunger scores of men, preoperatively

Table 1
Characteristics of Sociodemographic Surgical Experience and Fasting of the Patients (N = 85)

Characteristics	n (%)
Mean age (mean/SD)	53.95 (15.80)
Age	
40 and younger	14 (16.5)
40 and older	71 (83.5)
Gender	
Female	26 (30.6)
Male	59 (69.4)
Education*	
Low	67 (92.9)
High	6 (7.1)
Type of surgery	
Thoracotomy	62 (72.9)
Mediastinoscopy	19 (22.4)
Rib resection	4 (4.7)
POF time (h)	
8	14 (16.5)
9	22 (25.9)
10	27 (31.8)
11 and more	22 (25.9)
Mean POF (mean/SD)	10.16 (1.67)
POF start time	
After 24.00 night	82 (96.5)
After 02.00	3 (3.5)
Compliance with POF time	
Compatible	84 (98.8)
Not compatible	1 (1.2)
The reason for POF	
Knowing	45 (52.9)
Not knowing	40 (47.1)
Information about fasting	
Informed	67 (78.8)
Not informed	18 (21.2)
Difficulties related to POF	
Thirstiness	59 (69.4)
Sense of hunger	33 (38.8)
Dry mouth	27 (31.8)
Restlessness	20 (23.5)
Dizziness and weakness	11 (12.9)
Headache	13 (15.3)
Bad breath	5 (5.9)
Postoperative fasting time (h)	
6	22 (25.9)
8	13 (15.3)
9 and more	50 (58.8)
Mean postoperative fasting time	3.14 (SD = 3.07)
Total fasting time (preoperatively to postoperatively) (h)	
16-28	43 (50.6)
29-47	42 (49.4)
Total fasting time average	28.09 ± 7.11 (16-47)

POF, preoperative fasting.
* Low: literate, primary, and secondary; high: high school, undergraduate, and postgraduate.

and postoperatively, were higher than those of the women. There was a statistically significant difference between preoperative hunger scores of male and female patients ($P < .05$), but there was no statistically significant difference postoperatively ($P > .05$). Patients with a high education level had high hunger and thirst scores but did not experience headaches preoperatively and postoperatively. According to education level, patient preoperative and postoperative hunger and thirst scores were not statistically significant ($P > .05$), but a statistically significant difference was observed for postoperative headache scores ($P < .05$; Table 3).

As shown in Table 4, the average thirst score was higher in patients who fasted for 29 to 47 hours preoperatively and postoperatively. There was a statistically significant difference between total fasting times and the average thirst score of patients ($P < .05$). There were no statistically significant differences between total fasting times of patients and mean scores for fasting and headaches ($P > .05$). It was found that as the preoperative and total fasting time increased, thirst increased, and there was a statistically significant difference between POF and total fasting duration and thirst ($P < .05$). Patients experienced hunger at the 11th hour and greater and more headache at the 10th hour before surgery. Patients who were fasting for a total of 16 to 18 hours experienced hunger, and patients with 29 to 47 hours of hunger experienced more headache but were not statistically significant ($P > .05$).

As shown in Table 5, Pearson correlation showed a positive relationship between POF and thirst, and hunger ($r = 0.402$; $P = .000$), preoperative and postoperative thirst ($r = 0.450$; $P = .000$), and fasting ($r = 0.452$; $P = .000$). A positive correlation was observed between total protein levels and thirst ($r = 0.259$; $P = .017$) and albumin levels ($r = 0.508$; $P = .000$) in the preoperative period and also between total protein levels, albumin levels ($r = 0.499$; $P = .000$) and glucose levels ($r = 0.371$; $P = .000$) at preoperative and postoperative periods. There was a positive correlation between total fasting times and POF times ($r = 0.217$; $P = .046$), thirst ($r = 0.353$; $P = .001$), total protein ($r = 0.327$; $P = .002$), and glucose levels ($r = 0.277$; $P = .010$).

Discussion

To the best of our knowledge, this study is the first to evaluate the effect of POF in Turkish adult patients, undergoing thoracic surgery. Our data revealed that patients fasted for longer hours than recommended by POF guidelines.[8] Also, although POF is a clinical necessity, prolonged POF may cause many physiological and psychological problems, and in general, is an unpleasant experience. In a study in Africa,[13] it was found that the average fasting time of elective surgery patients was 7.65 times longer for clear fluid and 2.5 times longer for solids than ASA guidelines recommend. In another study,[25] patients fasted for an average of 13.6 hours of solid food and 8.8 hours of clear liquids. Similar to our data, other studies have shown that POF durations can be extended by up to 12 to 25 hours.[13,16,20,26-30]

Our findings also showed that plasma glucose levels increased and total protein levels decreased in patients who fasted after midnight (2400 hour). Previous studies supported our findings; glucose levels increased[31,32] and albumin level decreased in patients with a fasting time of 8 hours.[32] Surgical procedures and anesthesia exert unique effects on plasma glucose and protein levels, which should be taken into consideration. Prolonged POF

Table 2
Distribution Preoperative and Postoperative Total Protein, Albumin, and Plasma Glucose Levels of Patients (N = 85)

Blood Value	Preoperative Period		Postoperative Period		t Test	P
	Minimum-Maximum	Mean ± SD	Minimum-Maximum	Mean ± SD		
Total protein	5.21-7.94	6.84 ± 0.54	3.11-7.61	5.85 ± 0.78	13.579	<.001
Albumin	3.01-5.03	4.02 ± 0.45	2.06-4.96	3.41 ± 0.53	11.659	<.001
Glucose	57-273	108.52 ± 33.63	84-300	133.44 ± 41.86	−5.539	<.001

Table 3
Preoperative and Postoperative Total Protein, Albumin, and Plasma Glucose Levels With Thirst, Hunger, and Headache According to Some Characteristics of Patients (N = 85)

	Age			Gender			Education*		
	40 y and Younger	40 y and Older	*t* Test/*P*	Female	Male	*t* Test/*P*	Low	High	*t* Test/*P*
	Mean ± SD			Mean ± SD			Mean ± SD		
Preoperative									
Total protein	6.97 ± 0.50	6.82 ± 0.54	1.048/.31	6.78 ± 0.58	6.87 ± 0.52	−0.743/.459	6.78 ± 0.56	7.08 ± 0.37	−2.122/.037
Albumin	4.26 ± 0.50	3.97 ± 0.43	2.218/.03	3.99 ± 0.48	4.03 ± 0.44	−0.353/.459	3.93 ± 0.43	4.36 ± 0.37	−3.807/.000
Glucose	96 ± 19	111 ± 35	−1.509/.135	104 ± 38	110 ± 32	−0.729/.468	110.1 ± 35.9	102.7 ± 23.5	0.822/.414
Postoperative									
Total protein	6.07 ± 0.60	5.81 ± 0.81	1.116/.268	5.95 ± 0.63	5.81 ± 0.84	−0.734/.465	5.85 ± 0.77	5.86 ± 0.86	−0.026/.979
Albumin	3.71 ± 053	3.35 ± 0.52	2.402/.019	3.45 ± 0.52	3.39 ± 0.54	0.478/.634	3.38 ± 0.50	3.53 ± 0.64	−1.069/.288
Gluose	129 ± 36	134 ± 43	−0.425/.672	132 ± 48	134 ± 39	−0.249/.804	134.8 ± 43.3	128.4 ± 36.7	0.567/.572
Preoperative									
Thirstiness	4 ± 2.6	2.96 ± 2.9	1.248/.216	2.58 ± 2.76	3.37 ± 2.9	−1.183/.240	2.97 ± 2.96	3.72 ± 2.45	−0.989/.326
Hunger	2.64 ± 2.56	1.28 ± 2.26	2.018/.047	0.73 ± 1.51	1.85 ± 2.57	−2.497/.015	1.34 ± 2.31	2.11 ± 2.45	−1.235/.220
Headache	0	0.28 ± 0.72	−3.293/.002	0.5 ± 0.91	0.12 ± 0.49	2.019/.052	0.25 ± 0.70	0.17 ± 0.5	0.490/.625
Postoperative									
Thirstiness	6.14 ± 2.8	5.2 ± 3.31	0.999/.320	4.54 ± 3.31	5.71 ± 3.16	−1.554/.124	5.36 ± 3.27	5.33 ± 3.22	−0.029/.977
Hunger	3.86 ± 3.06	3 ± 3.08	0.954/.343	2.19 ± 2.79	3.56 ± 3.12	−1.921/.058	3.09 ± 3.14	3.33 ± 2.87	−0.297/.767
Headache	0.57 ± 2.14	0.65 ± 1.46	−0.165/.869	1.15 ± 2.05	0.41 ± 1.26	1.718/.095	0.76 ± 1.73	0.17 ± 0.51	1.433/.017

* Low education: literate, primary, and secondary; high education: high school and university.

may trigger biochemical reactions that initiate gluconeogenesis, lipolysis, proteolysis, and insulin resistance and potentially serum glucose level increases (stress hyperglycemia).[16] This condition results from surgical stress response and is defined as a temporary increase in plasma glucose in the absence of diabetes, resulting from a transient decrease in insulin response after a surgical procedure.[33,34] Moreover, major surgeries involving the thorax and abdomen are associated with more prolonged hyperglycemia.[33,34] This is a common clinical problem, and its prevalence is reportedly between 29.1%[35] and 40%[36] in patients undergoing surgery. A clear relationship exists between stress hyperglycemia in the preoperative period and adverse clinical outcomes.[37] It is accepted that hyperglycemia, polymorphonuclear neutrophils, and macrophages disrupt chemotactic, phagocytic, and microbicidal activities,[36] which play essential roles in host inflammatory responses against infection. Also, hyperglycemia contributes to cellular damage as well as vascular and immune dysfunction.[38] Stress hyperglycemic-mediated wound healing is associated with increased wound infections and other comorbidities, such as ischemia, sepsis, and death.[39] Stress hyperglycemia impacts nondiabetic patients more adversely than those with diabetes.[40,41] Also, metabolic responses to surgery involve catabolic impacts on protein metabolism, leading to a net protein loss in the body, causing, for example, a negative nitrogen imbalance.[8,15,42] For these reasons, the patients' POF period should not be extended longer than necessary.

The most common symptoms of prolonged POF include hunger, headache, dry mouth, dry lips, thick saliva, dry throat, bad taste, and desire to drink water. We determined that patients experiencing long fasting times (11 hours and higher) in the preoperative period experienced greater thirst, hunger, dry mouth, restlessness, weakness and dizziness, headache, and bad breath (69.4%, 38.8%, 31.8%, 23.5%, 12.9%, and 5.9%, respectively), when compared with patients with a shorter fasting period. Power et al[43] showed that patients with a short POF period experienced less thirst, anxiety, and headaches. Similarly, other studies have observed preoperative thirst and hunger,[1,18,44] dry mouth,[25] preoperative starvation,[45] perioperative dry mouth, and bad breath issues in patients.[14]

POF guidelines recommend that healthy and low-risk patients undergoing elective surgery minimize the volume of gastric contents, while avoiding unnecessary thirst and dehydration. The correct implementation of POF protocol recommendations is vital for patient safety. However, this and other studies show that these recommendations are not fully implemented in many institutions. The reason for prolonged POF from midnight may be due to the fact that all patients are given the same instructions as if they were going to the OR for 7 a.m or 9 a.m surgery, and this has been accepted by patients and health care professionals for many years and allows changes to the OR schedule. For example, in one study, 46.2% of patients appreciated the critical role of instructions on POF.[1] It can be said that fasting times mostly depend on the suitability of department or OR management.

We determined that preoperatively and postoperatively, women younger than 40 years and patients with higher education levels had high total protein and albumin levels and low plasma glucose levels. Preoperatively and postoperatively, males had high total protein, albumin, and glucose levels than females. Preoperatively, according to the education level, the difference between albumin and total protein levels, and according to the age, albumin level was statistically significant. Different factors, such as age, gender, social factors, such as economic, cultural, and educational status, may affect protein intake in meals and distribution. With aging, hunger, smell, and taste sensitivity decrease, and stomach emptying slows down, and also the anabolic effect decreases as a result of age-related changes in protein metabolism. Sensitivity especially begins to decline in the late third decade and then decreases progressively throughout adult life. Therefore, with aging, protein loss

Table 4
Visual Analog Patient Satisfaction Scale Scores According to Perioperative and Total Fasting Time of Patients (N = 85)

	Visual Analog Patient Satisfaction (Mean ± SD)		
	Thirstiness	Hunger	Headache
POF time (h)			
8	3.08 ± 2.06	1.62 ± 1.89	0.23 ± 0.44
9	2.35 ± 2.68	1.20 ± 2.02	0.00 ± 0.00
10	3.19 ± 3.26	1.45 ± 2.58	0.45 ± 0.96
11 and higher	4.12 ± 2.83	1.65 ± 2.64	0.12 ± 0.46
F	1.167	0.134	2.124
P	.328	.939	.104
Total fasting time (h)			
16-28	7.02 ± 5.41	4.81 ± 4.76	0.56 ± 1.35
29-47	9.98 ± 4.57	4.45 ± 4.56	1.19 ± 2.13
t Test	−2.716	0.357	−1.637
P	.008*	.722	.105

POF, preoperative fasting.
* Significant at $P < .05$.

Table 5
Pearson Correlation Between Effects Preoperatively and Postoperatively of POF Time

			Preoperative Period			Postoperative Period			Preoperative Period			Postoperative Period			
		POF Time	Thirst	Hunger	Headache	Thirst	Hunger	Headache	Albumin	Protein Total	Glucose	Albumin	Protein Total	Glucose	Fasting Total
Preoperative period	POF time	1													
	Thirst	0.213*	1												
	Hunger	0.055	0.402†	1											
	Headache	−0.023	.165	−0.039	1										
Postoperative period	Thirst	0.010	0.450†	0.144	0.022	1									
	Hunger	−0.033	−0.002	0.452†	−0.173	0.143	1								
	Headache	−0.098	−0.196	0.057	0.151	−0.038	0.238*	1							
Preoperative period	Albumin	−0.170	0.049	−0.102	0.027	0.085	−0.035	0.175	1						
	Total protein	−0.193	0.259*	0.026	0.025	0.210	0.009	−0.090	0.508†	1					
	Glucose	−0.034	−0.059	−0.161	−0.083	−0.124	−0.072	0.090	−0.184	−0.013	1				
Postoperative period	Albumin	−0.056	0.006	−0.060	−0.066	−0.017	0.121	0.180	0.527†	0.322†	−0.120	1			
	Total protein	−0.147	0.079	0.058	0.025	−0.042	0.168	−0.032	0.140	0.537†	0.110	0.499†	1		
	Glucose	0.032	−0.095	−0.091	−0.191	0.131	0.037	0.015	−0.142	0.046	0.371†	−0.103	−0.029	1	
	Fasting total	0.217*	0.207	0.002	0.136	0.353†	−0.001	0.161	0.080	−0.004	−0.034	−0.189	−0.327†	0.277*	1

POF, preoperative fasting.
*$P < .01$.
†$P < .001$.

increases gradually in the body. A study[46] indicated that the protein intake pattern differs significantly between age groups and genders, suggesting that serum albumin concentration decreases with age and values in females decrease more rapidly. McPherson et al[47] found that women taking oral contraception had serum albumin level lower than those who were not, and hence, supporting a hormonal basis for the differences between males and females (lower by approximately 2 g/L in females). In addition, the main reason male patients have a higher protein and albumin level is because they have a higher chance of access to food that is rich in protein because of their having the anabolic hormone testosterone and their economic opportunities, which women fail to obtain. Education is also important to lead and maintain a better life and increases nutritional status because it is one of the best indicators of economical and health literacy level. Within the scope of this study, it was assumed that patients with higher educational status had higher scores of total protein and albumin because they had a diet on protein-rich food.

In the present study, a positive correlation was observed between total fasting time and POF time, thirst, and total protein and glucose levels. POF had an adverse effect on thirst and hunger and total protein, albumin, and glucose levels. The surgery stress response leads to a number of predictable metabolic changes that may be exacerbated by prolonged preoperative and postoperative fasting.[48] These metabolic changes are due to a decrease in the normal anabolic effects of insulin as a result of a temporary increase in insulin resistance, which increases serum glucose levels.[49,50] Implementation of ERAS protocol for reduced POF may achieve an appreciable reduction in fasting times and enhanced patient comfort without compromising patient safety by evaluating the patients' condition as much as possible.

Limitations of the Study

As the limitations of this study, the sample was consecutive and not randomized and without a control group; it is a single-center study. In addition, liquids and solid food intake were not examined one by one; the total fasting time was evaluated.

Conclusions

Worldwide fasting is a medical and legal requirement to maintain patient safety within a surgical context. However, prolonged POF is an unnecessary and harmful situation for healthy people who do not have additional comorbid diseases. Thus, fasting times for preoperative and postoperative periods can be shortened to appropriate periods dictated by the guidelines. Further studies are required to determine optimal fasting times and their effects on patient outcomes.

References

1. Njoroge G, Kivuti-Bitok L, Kimani S. Preoperative fasting among adult patients for elective surgery in a Kenyan Referral Hospital. *Int Sch Res Notices*. 2017;2017:2159606.
2. Lambert E, Carey S. Practice guideline recommendations on perioperative fasting: A systematic review. *JPEN J Parenter Enteral Nutr*. 2016;40:1158−1165.
3. Mendelson CL. The aspiration of stomach contents into the lungs during obstetric anesthesia. *Am J Obstet Gynecol*. 1946;52:191−205.
4. Xu D, Zhu X, Xu Y, Zhang L. Shortened preoperative fasting for prevention of complications associated with laparoscopic cholecystectomy: A meta-analysis. *J Int Med Res*. 2017;45:22−37.
5. Abd El-Naby AG, El-Sayed ZM. Preoperative fasting time and selected postoperative outcomes among patients undergoing abdominal surgeries: Correlation study. *J Health Med Nurs*. 2016;26:109−119.
6. Nason KS. Acute intraoperative pulmonary aspiration. *Thorac Surg Clin*. 2015;25:301−307.
7. Neilipovitz DT, Crosby ET. No evidence for decreased incidence of aspiration after rapid sequence induction. *Can J Anaesth*. 2007;54:748-764.

8. Chon T, Ma A, Mun-Price C. Perioperative fasting and the patient experience. *Cureus*. 2017;9:e1272.
9. American Society of Anesthesiologist Task Force on Preoperative Fasting. Anesthesiology. Practice guidelines for preoperative fasting and the use of pharmacological agents to reduce the risk of pulmonary aspiration: Application to healthy patients undergoing elective procedures. *Anesthesiology*. 1999;90:896–905.
10. The American Society of Anesthesiologists. Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: Application to healthy patients undergoing elective procedures. *Anesthesiology*. 2011;114:495–511.
11. Falconer R, Skouras C, Carter T, Greenway L, Paisley AM. Preoperative fasting: Current practice and areas for improvement. *Updates Surg*. 2014;66:31–39.
12. Fawcett WJ, Thomas M. Pre-operative fasting in adults and children: Clinical practice and guidelines. *Anesthesia*. 2019;74:83–88.
13. Abebe WA, Rukewe A, Bekele NA, Stoffel M, Dichabeng MN, Shifa JZ. Preoperative fasting times in elective surgical patients at a referral hospital in Botswana. *Pan Afr Med J*. 2016;23:102.
14. Martins PR, Fonseca LF, Rossetto EG. Developing and validating the Perioperative Thirst Discomfort Scale. *Rev Esc Enferm USP*. 2017;51:e03240.
15. Hamid S. Pre-operative fasting—A patient centered approach. *BMJ Qual Improv Rep*. 2014;2. u605.w1252.
16. Tosun B, Yava A, Açıkel C. Evaluating the effects of preoperative fasting and fluid limitation. *Int J Nurs Pract*. 2015;21:156–165.
17. Adanir T, Aksun M, Ozgürbüz U, Altin F, Sencan A. Does preoperative hydration affect postoperative nausea and vomiting? A randomized controlled trial. *J Laparoendosc Adv Surg Tech A*. 2008;18:1–4.
18. Ajuzieogu OV, Amucheazi AO, Nwagha UI, Ezike HA, Luka SK, Abam DS. Effect of routine preoperative fasting on residual gastric volume and acid in patients undergoing myomectomy. *Niger J Clin Prac*. 2016;19:816–820.
19. Pimenta GP, de Aguilar-Nascimento JE. Prolonged preoperative fasting in elective surgical patients: Why should we reduce it? *Nutr Clin Pract*. 2014;29:22–28.
20. Özkan M, Gökkaya Z, Sarıtaş S. The effect of preoperative fluid and solid food restriction on anxiety. *İnönü Üniversitesi Sağlık Hizmetleri Meslek Yüksekokulu Dergisi*. 2016;5:1–11.
21. Batchelor TPG, Rasburn NJ, Abdelnour-Berchtold E, et al. Guidelines for enhanced recovery after lung surgery: Recommendations of the Enhanced Recovery After Surgery (ERAS®) Society and the European Society of Thoracic Surgeons (ESTS). *Eur J Cardiothorac Surg*. 2019;55:91–115.
22. Goyal RK, Guo Y, Mashimo H. Advances in the physiology of gastric emptying. *Neurogastroenterol Motil*. 2019;31:e13546.
23. D'Andrilli A, Rendina EA. Enhanced recovery after surgery (ERAS) and fast-track in video assisted thoracic surgery (VATS) lobectomy: Preoperative optimisation and care-plans. *J Vis Surg*. 2018;4:4.
24. Kılınçer C, Zileli M. Visual analog patient satisfaction scale. *J Trakya Univ Medical Faculty*. 2006;23:113–118.
25. Ingadottir B, Olafsdottir AM, Sveinsdottir H, et al. Preoperative fasting: Instructions to patients and length of fasting—A prospective, descriptive survey. *Laeknabladid*. 2016;102:283–288.
26. Li Y, He R, Ying X, Hahn RG. Dehydration, hemodynamics and fluid volume optimization after induction of general anesthesia. *Clinics (Sao Paulo)*. 2014;69:809–816.
27. Khoyratty S, Din AH, Spendlove R, et al. The impact of discussing preoperative fasting with patients. *J Perioper Pract*. 2011;21:284–286.
28. Gül A, Özkaya B. Preoperative fasting and patients' discomfort. *Indian J Surg*. 2018;80:549–553.
29. Demirdağ H, Karaöz S. Patients "experiences about preoperative fasting and nurses" knowledge and practice. *Florence Nightingale J Nurs*. 2015;23:1–10.
30. de Aguilar-Nascimento JE, de Almeida Dias AL, Dock-Nascimento DB, et al. Actual preoperative fasting time in Brazilian hospitals: The BIGFAST multicenter study. *Ther Clin Risk Manag*. 2014;10:107–112.
31. Faria MS, de Aguilar-Nascimento JE, Pimenta OS, Alvarenga Jr LC, Dock-Nascimento DB, Slhessarenko N. Preoperative fasting of 2 hours minimizes insulin resistance and organic response to trauma after video-cholecystectomy: A randomized, controlled, clinical trial. *World J Surg*. 2009;33:1158–1164.
32. Machado PA, de Oliveira BD, Dock-Nascimento DB, de Aguilar-Nascimento JE. Shrinking preoperative fast time with maltodextrin and protein hydrolysate in gastrointestinal resections due to cancer. *Nutrition*. 2013;29:1054–1059.
33. Palermo NE, Gianchandani RY, McDonnell ME, Alexanian SM. Stress hyperglycemia during surgery and anesthesia: Pathogenesis and clinical implications. *Curr Diab Rep*. 2016;16:33.
34. Duggan EW, Carlson K, Umpierrez GE. Perioperative hyperglycemia management: An update. *Anesthesiology*. 2017;126:547–560.
35. Kwon S, Thompson R, Dellinger P, Yanez D, Farrohki E, Flum D. Importance of perioperative glycemic control in general surgery: A report from the Surgical Care and Outcomes Assessment Program. *Ann Surg*. 2013;257:8–14.
36. Frisch A, Chandra P, Smiley D, et al. Prevalence and clinical outcome of hyperglycemia in the perioperative period in noncardiac surgery. *Diabetes Care*. 2010;33:1783–1788.
37. Alba-Loureiro TC, Munhoz CD, Martins JO, et al. Neutrophil function and metabolism in individuals with diabetes mellitus. *Braz J Med Biol Res*. 2007;40:1037–1044.
38. Farrokhi F, Smiley D, Umpierrez GE. Glycemic control in non-diabetic critically ill patients. *Best Pract Res Clin Endocrinol Metab*. 2011;25:813–824.
39. Davis G, Fayfman M, Reyes-Umpierrez D, et al. Stress hyperglycemia in general surgery: Why should we care? *J Diabetes Complications*. 2018;32:305–309.
40. Bláha J, Mráz M, Kopecký P, et al. Perioperative tight glucose control reduces postoperative adverse events in nondiabetic cardiac surgery patients. *J Clin Endocrinol Metab*. 2015;100:3081–3089.
41. Kotagal M, Symons RG, Hirsch IB, et al. SCOAP-CERTAIN collaborative perioperative hyperglycemia and risk of adverse events among patients with and without diabetes. *Ann Surg*. 2015;261:97–103.
42. Ruth MS, Josephine MS, Williams A. Preoperative fasting in the day care patient population at a tertiary care, teaching institute: A prospective, cross-sectional study. *CHRISMED J Health Res*. 2018;5:105–109.
43. Power S, Kavanagh DO, McConnel G, et al. Reducing preoperative fasting in elective adult surgical patients: A case-control study. *Ir J Med Sci*. 2012;181:99–104.
44. Gebremedhn EG, Nagaratnam VB. Audit on preoperative fasting of elective surgical patients in an African academic medical center. *World J Surg*. 2014;38:2200–2204.
45. Roberts S. Preoperative fasting: A clinical audit. *J Perioper Pract*. 2013;23:11–16.
46. Weaving G, Batstone GF, Jones RG. Age and sex variation in serum albumin concentration: An observational study. *Ann Clin Biochem*. 2016;53:106–111.
47. McPherson K, Healy MJR, Flynn FV, et al. The effect of age, sex and other factors on blood chemistry in health. *Clin Chim Acta*. 1978;84:373–397.
48. Fawcett WJ, Ljungqvist O. Starvation, carbohydrate loading, and outcome after major surgery. *BJA Education*. 2017;17:312–316.
49. Dock-Nascimento DB, de Aguilar-Nascimento JE, Magalhaes Faria MS, Caporossi C, Slhessarenko N, Waitzberg DL. Evaluation of the effects of a preoperative 2-hour fast with maltodextrine and glutamine on insulin resistance, acute-phase response, nitrogen balance, and serum glutathione after laparoscopic cholecystectomy: A controlled randomized trial. *JPEN J Parenter Enteral Nutr*. 2012;36:43–52.
50. Thorell A, Nygren J, Ljungqvist O. Insulin resistance: A marker of surgical stress. *Curr Opin Clin Nutr Metab Care*. 1999;2:69–78.