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Original Article / Özgün Makale

Determination of food intake and the factors affecting food intake in perioperative period in patients who undergo open heart surgery

Açık kalp cerrahisi uygulanan hastalarda perioperatif dönemde besin alımının ve besin alımını etkileyen etkenlerin belirlenmesi

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ABSTRACT

Background: This study aims to investigate the factors affecting food intake in perioperative period of patients who undergo open heart surgery and the effects of body weight, albumin and hemoglobin values, nausea, vomiting and constipation on food intake.

Methods: This cross-sectional study was conducted between 4 February 2015 and 4 May 2015 in a cardiovascular surgery clinic. A questionnaire including 25 questions was applied to a total of 86 volunteer participants (62 males, 24 females; mean age 61.3±10.8 years; range 38 to 82 years).

Results: Patients consumed 38% of the food one day before the surgery and 51% one day after, 47% three days after, and 52% five days after the surgery. Factors affecting food intake were the procedure of discontinuing food intake for pre-surgery anesthesia preparation (84.9%), nausea (31.4%) one day after surgery, and constipation three (26.5%) and five (33.7%) days after surgery. Albumin levels decreased significantly in days after surgery compared to the day before surgery ($p<0.05$). There was a significant positive correlation between food intake rates and albumin levels on the first, third and fifth days after surgery ($r=0.354$, $r=0.353$, and $r=0.521$, respectively; $p<0.05$).

Conclusion: Patients' body weight and albumin levels decreased in accordance with their nourishment status after surgery. Food intake was insufficient in the perioperative period.

Keywords: Food intake; heart surgery; malnutrition; nursing care.

ÖZ

Amaç: Bu çalışmada açık kalp cerrahisi uygulanan hastaların perioperatif dönemde besin alımını etkileyen faktörler ve vücut ağırlığı, albümin ve hemoglobin değerleri, mide bulantısı, kusma ve kabızlığın besin alımı üzerindeki etkileri araştırıldı.

Çalışma planı: Bu kesitsel çalışma 4 Şubat 2015-4 Mayıs 2015 tarihleri arasında bir kalp damar cerrahisi kliniğinde gerçekleştirildi. Toplam 86 gönüllü katılımcıya (62 erkek, 24 kadın; ort. yaş 61.25±10.77 yıl; dağılım 38-82 yıl) 25 sorudan oluşan bir anket formu uygulandı.

Bulgular: Hastalar cerrahiden bir gün önce besinin %38'ini, cerrahiden bir gün sonra %51'ini, üç gün sonra %47'sini ve beş gün sonra %52'sini tüketti. Besin alımını kesintiye uğratan faktörler cerrahi öncesi anestezi hazırlığında besin alımını durdurma prosedürü (%84.9), cerrahiden bir gün sonra bulantı (%31.4) ve cerrahiden üç (%26.5) ve beş (%33.7) gün sonra kabızlık idi. Albümin düzeyleri cerrahiden sonraki günlerde cerrahiden önceki bir güne kıyasla anlamlı olarak azaldı ($p<0.05$). Cerrahi sonrası birinci, üçüncü ve beşinci günlerde besin alımı oranları ile albümin düzeyleri arasında anlamlı bir pozitif ilişki vardı (sırasıyla $r=0.354$, $r=0.353$ ve $r=0.521$; $p<0.05$).

Sonuç: Cerrahi sonrası hastaların beslenme durumlarına göre vücut ağırlıkları ve albümin düzeyleri azaldı. Perioperatif dönemde besin alımı yetersiz idi.

Anahtar sözcükler: Besin alımı; kalp cerrahisi; beslenme yetersizliği; hemşirelik bakımı.

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In case of illness, the need for nutritional ingredients increases and nutritional deficiency (ND) can be seen even in cases where daily food intake has not changed. It was determined that daily food intake could not meet the required energy of patients in hospitals, and therefore, was inadequate.[1] The European Society for Clinical Nutrition and Metabolism (ESPEN) defined ND as disease-related weight loss, protein deficiency and hunger for certain foods. It is stated that the severity of the illness and treatment and care practices are responsible for the development of ND.[2] Most surgical interventions involve a preoperative preparation of diagnostic tests that often requires patients to be hungry, and a long perioperative period of events that interrupt food intake.

Although the American Society of Anesthesiologists (ASA) and ESPEN 2017 Guidelines recommend stopping solid food intake up to six-eight hours before the surgery,[2] delaying the onset of surgery for various reasons leads to the prolongation of this process.[3] In open heart surgery (OHS), the intraoperative and postoperative intubation periods last longer than most surgical procedures. In addition, with procedural interventions after extubation, the time from the patient's final pre-surgery food intake to postoperative intake can be extended up to 20-24 hours in some cases.[3,4] In patients undergoing OHS, the prevalence of perioperative ND is between 10% and 35%.[5-7] After surgery, ND threatens life by increasing complications such as nosocomial superinfection, cardiogenic shock, systemic inflammatory response syndrome, infection, sepsis, atrial fibrillation and delirium, and delays healing by reducing surgical tolerance.[7]

Despite evidence-based practice and current guidelines (ASA, ESPEN 2017) for shortening the preoperative fasting period and early enteral nutrition postoperatively, it seems that ND cannot be prevented. Patients lose weight, remain weak, and have complications due to ND.[2] It is recommended to monitor and evaluate the food intake throughout the perioperative period in order to enable early identification and prevention of ND in patients undergoing OHS.[8,9] It is also necessary to increase the awareness of healthcare staff and to plan effective treatment by determining factors affecting food intake. To our knowledge, in the literature, there is no study of nutritional intake in patients undergoing OHS; the causes that inhibit food intake have not been identified. There is no standard protocol or universal model for the monitoring and prevention of ND.[2] There are not enough studies regarding nutritional status, conditions affecting food intake and short-term effects of changing food intake in the perioperative period. Therefore, in this study, we aimed to investigate the factors affecting food intake in perioperative period of patients who undergo OHS and the effects of body weight, albumin and hemoglobin values, nausea, vomiting and constipation on food intake.

PATIENTS AND METHODS

The cross-sectional study was conducted at the Cardiovascular Surgery service (CVS) of Gülhane Training and Research Hospital in Ankara between 4 February 2015 and 4 May 2015. The study protocol was approved by the Gülhane Training and Research Hospital Ethics Committee (decision no: 506874691491-115.15/1648-4-240). A written informed consent was obtained from each patient. The study was conducted in accordance with the principles of the Declaration of Helsinki.

The study universe consisted of 174 patients who underwent OHS in the CVS service between the aforementioned dates. A total of 102 patients were invited to participate in the study. The sample of the study consisted of patients who were above the age of 18 and were going to have an OHS for the

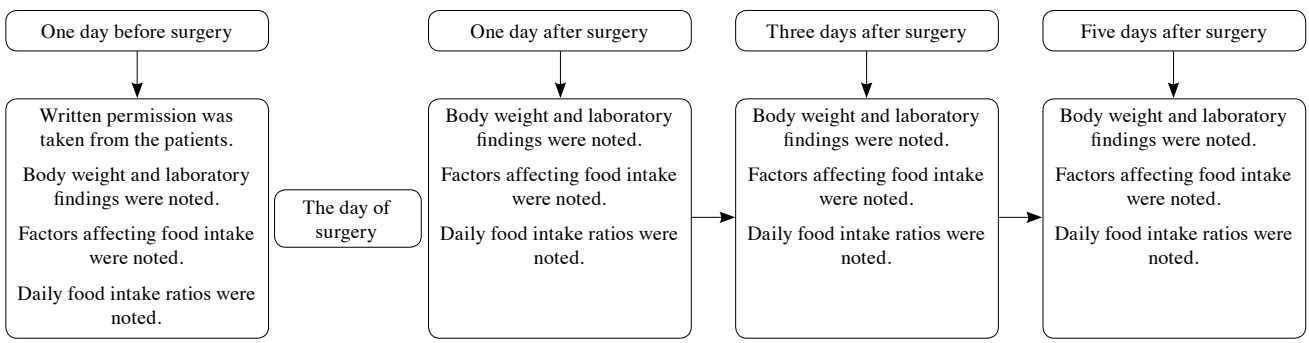

Figure 1. Application of research.

first time. They were volunteers who did not have any psychological disease diagnosis. They were also conscious after extubation (Glasgow Coma Score ≥14) and did not receive any ND related treatment within the last year before surgery. Out of 102 patients invited to the research, a total of 16 patients were excluded: 10 patients with a complication that may affect the nutritional status during surgery, four patients whose consciousness level changed (Glasgow Coma score <14) after extubation, and two patients who desired to leave the research. The data were collected from 86 patients (62 males, 24 females; mean age 61.3±10.8 years; range, 38 to 82 years).

The data of the study were collected by the researchers through the Data Form, which was formed as a result of the literature review[5,7,10] and consisted of two parts. In Part I, questions such as age, gender, education level, place of residence, working status, diet preference, prosthetic tooth use, companion status, chronic disease status, continuous drug use, type and duration of the surgery, intensive care and hospital stay duration were included. The questions in this section were filled out by the researcher with the information obtained from the patients and patient files. Part II consisted of expressions of intake of food*, body weight, albumin, hemoglobin and fasting

Table 1. Demographic features of patients (n=86)

	n	%	Mean±SD	Range
Age (year)			61.3±10.8	38-82
The youngest - the oldest				
≤65 years	52	60.5		
>66 years	34	39.5		
Gender				
Female	24	27.9		
Male	62	72.1		
Educational status				
Elementary school	26	30.2		
High school	35	40.7		
Undergraduate and graduate	25	29.1		
Working status				
Actively working	47	54.7		
Retired	14	16.3		
Housewife	17	19.8		
Unemployed	8	9.3		
Usage of denture				
Existent	31	36.0		
None	55	64.0		
Chronic illness				
Existent	34	39.5		
None	52	60.5		
Distribution of chronic illnesses*				
Hypertension	11	12.8		
Kidney failure	3	3.5		
Diabetes	18	20.9		
Chronic obstructive respiratory disease	2	2.3		
Permanent drug user				
Yes	64	74.4		
No	22	25.6		
Type of surgery				
CABG**	64	74.4		
Valve surgery	19	22.1		
CABG** + valve surgery	3	3.5		

SD: Standard deviation; * Distribution of chronic diseases of 34 patients with chronic illness; ** Coronary artery bypass grafting; CABG: Coronary artery bypass grafting.

Table 2. Food intake rates of patients before and after surgery

Rates of food consumption in a day	One day before surgery				One day after surgery				Three days after surgery				Five days after surgery			
	n	%	Mean	Min-Max	n	%	Mean	Min-Max	n	%	Mean	Min-Max	n	%	Mean	Min-Max
≤25%	4	4.7			9	10.5			2	2.4			4	4.7		
26-50%	82	95.3	38	20-50	25	29.1	51	25-75	53	62.0	47	20-75	31	36.0	52	20-75
51-75%	0				52	60.4			31	35.6			51	59.3		
76-100%	0				0	0.0			0	0.0			0	0.0		

Min: Minimum; Max: Maximum.

blood sugar values before and after surgery on the first, third, and fifth day, as well as identifying **situations that may affect food intake of patients (the day of surgery was considered as day zero, and the day after was considered as day one). The data in this section were collected on the first, third and fifth days in the evening (between 18:00 and 20:00 pm).

Food intake status: Patients were asked to indicate the amount of food they consumed in the CVS service during breakfast, morning snack, lunch, mid-afternoon snack, and dinner each day (as percentage %). Each patient was given a sample meal to demonstrate them the amount of meal they should mark. For instance, patients were told to mark 50% if they consumed only half of the breakfast, and mark 25% if they consumed the quarter of the food. At the end of each data collection day, the rate of food intake for each meal of the patients was summed up, divided by the number of meals given to the patients that day, and the daily intake rate was calculated (Figure 1).

Conditions affecting the food intake of patients: A total of 25 statements were formed based on the literature review and clinical observations of researchers. In the Likert type question form, patients were asked to mark the choices of "Affected a lot", "Affected a little" and "Not affected". The statements in the questionnaire were administered four times: on the day before the surgery and on the first, third and fifth days after the surgery. The data collection form was filled through face to face interview on the day before the surgery and on the first, third and fifth days after the surgery (Figure 1). No additional blood tests were administered for the purpose of this research.

Statistical analysis

The data analysis was conducted through SPSS for Windows version 15.0 (SPSS Inc., Chicago, IL, USA) software. In the descriptive statistics, the number (n) and percentage (%) values of the categorical values were used and the mean ± standard deviation values were used for the demonstration of numerical values. Paired samples t-test was used for the determination of the difference between the previous and later measurement averages of continuous variables. Pearson's chi-square and Fisher's exact test were used for the comparisons of discrete variables. Spearman correlation analysis was used for the determination of the difference between categorical variables of demographic characteristics of the patients and their nutritional status. A p value <0.05 was accepted as statistically significant.

Table 3. Distribution of patients by their food intake

Factors affecting the food consumption		One day before surgery		One day after surgery		Three days after surgery		Five days after surgery	
		n	%	n	%	n	%	n	%
1.	I have oral and dental problems	-		10	11.6	3	3.5	3	3.5
2.	I am afraid of high blood pressure	15	17.4	10	11.6	14	16.3	6	7
3.	I am afraid of high blood sugar	7	8.1	8	9.3	15	17.4	5	5.8
4.	I am afraid that my angina pain will start	16	18.6	14	16.3	17	19.8	7	8.1
5.	I am constipated right now/ I'm worried about being constipated	-		9	10.5	22	25.6	29	33.7
6.	I am worried about food's causing gas	2	2.3	7	8.1	9	10.5	13	15.1
7.	It hurts when I eat.	-		10	11.6	5	5.8	8	9.3
8.	I get nausea before I eat	-		27	31.4	13	15.1	11	12.8
9.	I get nausea while I eat	-		27	31.4	13	15.1	11	12.8
10.	I have a loss of appetite	8	9.3	16	18.6	16	18.6	13	15.1
11.	I feel stressed	23	26.7	8	9.3	3	3.5	5	5.8
12.	I don't have my dentures with me.	-		5	5.8	3	3.5	-	
13.	I don't feel the taste of the food.	2	2.3	3	3.5	15	17.4	8	9.3
14.	I feel too sick to eat.	-		17	19.8	11	12.8	5	5.8
15.	I am afraid that veins in my arms will stand out.	-		15	17.4	4	4.7	5	5.8
16.	I am stressed	-		3	3.5	3	3.5	1	1.2
17.	I'm worried that the hospital fees will be higher.	1	1.2	-		1	1.2	1	1.2
18.	The explanations of doctors and nurses about the food intake limitations.	-		4	4.7	-		-	
19.	I haven't been informed about whether to eat or not	2	2.3	1	1.2	1	1.2	3	3.5
20.	I undergo painful procedures before meals.	-		17	19.8	7	8.1	11	12.8
21.	Doctors and nurses tell me not to eat.	73	84.9	17	19.8	-		-	
22.	The food lacks salt	4	4.7	10	11.6	11	12.8	20	23.3
23.	The food is too cold or too hot.	3	3.5	3	3.5	3	3.5	4	4.7
24.	The tableware is not clean.	1	1.2	-		1	1.2	2	2.3
25.	I am not accustomed to the food here.	3	3.5	3	3.5	2	2.3	6	7
26.	I am not accustomed to the meal times of the hospital	5	5.8	2	2.3	4	4.7	4	4.7

RESULTS

Of the 86 patients, 72.1% were males, 36% were using prosthetic dentures, 39.5% had a chronic disease, 74.4% had coronary artery bypass grafting surgery, and 74.4% had continuous drug use histories (Table 1).

An examination of the completion rates of daily meals in CVS service showed that one day before surgery, 95.3% of patients had 26-50% (mean 38%) of daily nutrition, while 60.4% had 51-75% (mean 51%) of daily nutrition one day after surgery, 62% had 26-50% (mean 47%) three days after surgery, and

Table 4. Distribution of gastrointestinal symptoms according to days before and after surgery

	One day after surgery		Three days after surgery		Five days after surgery	
	n	%	n	%	n	%
Nausea	27	31.4	13	15.1	11	12.8
Vomiting	11	12.8	3	3.5	2	2.3
Constipation	9	10.5	22	25.6	29	33.7
Diarrhea	0	0.0	2	2.3	0	0.0

59.3% had 51-75% (mean 52%) five days after surgery. There were no patients who consumed more than 75% of the daily food on each of the four monitoring days (Table 2).

In Table 3, data are provided about the statements "affects very much" related to food intake by patients before surgery and five days after surgery. The factors affecting the patients' eating habits most one day before surgery were "being told by the physician and the nurse to stay hungry" (84.9%), "feeling stressed" (26.7%) and "fearing the onset of angina pain" (18.6%). On the first day after surgery, "having nausea during the meal" (31.4%), "feeling too weak to eat" and "pre-meal painful procedures" (19.8%); on the second day after surgery, "being constipated and worrying about constipation" (25.6%), "having a loss of appetite" (18.6%) and "having a meal without salt" (12.8%); on the fifth day after surgery, "being constipated and worrying about constipation" (33.7%), "having a meal without salt" (23.3%) and "having a loss of appetite" (15.1%) were specified.

No gastrointestinal symptom was found in any patient before surgery, but the most common symptom on the first postoperative day was nausea (31.4%). The most common symptom after three and five days of surgery was constipation (25.6% and 33.7%, respectively) (Table 4).

Mean body weight was 76.4±12.0 kg one day before surgery; on the fifth day after surgery, mean body weight was 74.6±12.2 kg with a decrease of about 2 kg. Mean albumin level was 4.6±0.2 g/dL on the day before surgery and 3.8±0.6 g/dL on the fifth postoperative day. Hemoglobin value was 13.8±0.8 g/dL on the day before surgery and it decreased by 4 g/dL on average postoperatively (mean 9.7±1.3 g/dL). Mean of fasting blood sugar increased on the first and third days after surgery compared to the preoperative period and blood sugar reached the preoperative values on the fifth day after surgery (Table 5).

Mean values of weight, albumin, and hemoglobin of patients before surgery and at first, third, and fifth postoperative days were compared with the paired samples t-test. Difference between the average weights of the day before surgery and the first, third and fifth days after surgery was statistically significant (t=19.130, p=0.001; t=22.986, p=0.001; t=13.892, p=0.001, respectively). Difference between the averages of hemoglobin values of the day before surgery and the first, third and fifth days after surgery was statistically significant (t=25.078, p=0.001; t=33.096, p=0.001; t=28.886, p=0.001, respectively).

Differences between fasting blood sugar averages were not statistically compared since the fasting blood sugar values may be affected by many drugs such as cortisone or dextrose-containing fluids.

Relationship between the intake of nutrients on days after surgery and weight, albumin and hemoglobin values of participants was examined by Spearman correlation test. The serum albumin level decreased in the days after surgery. A low-level positive statistically significant relationship was found between postoperative food intake and serum albumin averages on the first and third days after surgery. On the fifth day, this relationship was middle-level (r=0.334, p=0.001; r=0.353, p=0.001; r=0.521, p=0.001, respectively). There was no significant relationship between nutritional status of the patients before and after surgery and their weight and hemoglobin values (p>0.05).

Relationship between the food intake rates of patients on the first, third and fifth days after surgery and nausea, vomiting, constipation was examined. Accordingly, there was a negative statistically significant relationship between nutritional status and nausea on the first and third days after surgery (r= -0.282, p=0.008; r= -0.233, p=0.031, respectively). No relationship was observed between other variables and food intake status (p>0.05).

Table 5. Patients' weights, albumin, hemoglobin, and fasting blood sugar values according to days before and after surgery

	One day before surgery		One day after surgery		Three days after surgery		Five days after surgery	
	Mean±SD	Min-Max	Mean±SD	Min-Max	Mean±SD	Min-Max	Mean±SD	Min-Max
Body mass (kg)	76.4±12.0	54-117	76.1±12.1	53-117	75.4±12.0	51-115	74.6±12.2	51-115
Albumin (g/dL)	4.6±0.2	4.10-5.10	4.3±0.3	3.70-4.80	4.0±0.3	3.50-4.60	3.8±0.6	2.50-4.60
Hemoglobin (g/dL)	13.8±0.8	12.70-16.00	9.5±1.6	7.30-14.10	9.1±1.3	7.20-13.30	9.7±1.3	7.30-12.30
Fasting blood sugar (mg/dL)	106.8±22.7	78-180	165.0±30.8	127-280	159.6±26.1	125-249	105.4±25.2	78-198

SD: Standard deviation; Min: Minimum; Max: Maximum.

DISCUSSION

In this study, patients consumed less than half of the required daily food (mean 38%) one day before surgery. Patients seemed to be influenced by the fact that they were told to remain hungry for diagnostic and therapeutic tests, and due to the clinical protocol. Similarly, in a study performed by Dupertuis et al.[11] with 1707 surgical patients, although adequate nutrition was given before surgery, patients did not consume enough nutrition. As a general practice in clinics, food intake is arranged simultaneously for patients scheduled for surgery early for the morning and for those scheduled for surgery for after lunch. In a survey with nurses and doctors in Turkey, it was reported that 43.8% of the participants who were scheduled surgery were applied after midnight hunger protocol routinely, and the rate of healthcare professionals' use of current hunger guidelines was very low.[3] We believe that pre-surgery liquid-food intake should be planned individually for each patient and that the emphasis should be placed on the patient's dinner.

In the current study, it was determined that the patients were stressed and worried due to surgery and this also affected their food intake before the surgery. In the literature, it has been reported that stress affects the nutritional status and there is a relationship between ND and depression in patients undergoing cardiac surgery.[12,13] It was also stated that angina pain reminds individuals of death, causing patients to experience stress.[14] In the study of Tosun et al.,[15] 58.6% of the patients experienced stress prior to surgery and the anxiety of the patients who were starving for longer than 12 hours was also high. It is known that allowing patients to express their anxiety before surgery, assessing their pain, giving information and training, and planning appropriate interventions are effective in reducing pain and surgical stress.[16] It may be beneficial to raise the awareness of healthcare personnel to control these conditions, which also negatively affect the food intake of patients.

After one, three and five days of surgery, patients had consumed approximately half of their meals (approximately 51%, 47%, and 52%, respectively). Any painful procedure before meals during the days after surgery was the most important factor that reduced the interest of patients in their diet. The effect of this condition can be reduced if painful procedures[17] such as injection, dressing, drainage tubing, and patient mobilization are not planned before the meal times. Other important factors affecting nutritional intake of patients after surgery are situations that may be improved such as current or possible constipation, and

the manner of food's presentation, taste and serving time. Dupertuis et al.[11] reported that inadequate food intake in hospitalized patients may be attributed to causes related to food presentation other than disease severity. It has been suggested that improving the quality of food presentation and presentation time in hospitals may be effective in increasing patients' intake of foods.

In the literature, it has been reported that the duration of surgical hunger and inadequate food intake increase nausea.[15] This negative relationship between food intake and nausea reinforces our interpretation. The most important symptom observed three and five days after surgery was constipation. Constipation may be due to the inactivity of patients and their lack of adequate nutrition after surgery. In addition, there is a negative relationship between food intake and constipation, which supports our evaluation. These symptoms after surgery were similar to those of the literature.[18]

The relationship of nutritional status was investigated on the values of albumin which have an important role in the healing of the patients who undergo OHS. A statistically significant decrease was determined when the patients' weights and albumin values were compared with those of the day before surgery. In patients undergoing cardiac surgery, daily protein intake should be at least 1.5 g/kg to ensure optimal healing. Glutamine is the main energy source of myositis. Omega-3 may help to reduce acute coronary syndromes and may prevent sudden deaths.[19] It has been reported that decreased body weights and serum albumin levels in patients undergoing cardiac surgery are important indicators of ND.[20] In this study, the relationship between decreased albumin levels and body weights suggests that patients suffered from ND in the postoperative period.

Several cohort studies have demonstrated that low albumin levels have a significant correlation with some complications after cardiac surgery.[21,22] In a study, it was found that the relationship between albumin levels and mortality was significant; hypoalbuminemia was associated with cardiac surgery; increased incidence of postoperative morbidity and mortality.[22] However, levels of hypoalbuminemia that should have caused these harmful effects have not been identified. Attempts to improve the nutritional status of patients may be effective in reducing the harmful effects of hypoalbuminemia due to ND by closely monitoring the nutritional status of patients undergoing cardiac surgery.

In the current study, there were significant decreases in hemoglobin values after surgery compared to the day before surgery. Hemoglobin, the main building element of protein, is a structure that can be influenced by the nutritional status of the individual.[23] The insufficiency of food intake might have affected this situation because of the positive relationship between the nutritional status of the patients and the albumin values on the first, third and fifth days after surgery. Because of the practice of OHS in this study, it has been assumed that decreased hemoglobin may be the effect of hemorrhage after surgery. The fact that the values of fasting blood sugar were higher one day before the surgery than those of one and three days after surgery may be because of increased cortisol due to surgical stress, cortisone given for surgery and dextrose solution given in intensive care unit after surgery.[24] Similar to the literature findings, mean values of fasting blood sugar were close to the preoperative values after five days of surgery.[25]

The most important limitations of our study are the small sample size and the study being single-centered. Moreover, the information on fluid balance that the patients received has not been collected, which may have affected body weight. Furthermore, a subjective method based on the patients' own expressions was used to determine the nutritional status and no calorie calculation was performed. However, our findings may be considered unique and valuable since, to our knowledge, this study was the first to investigate the perioperative effects of food intake on OHS and to identify the conditions that prevent food intake.

In conclusion, this study indicates that food intake was inadequate in all perioperative period and patients lost weight after surgery. Average hemoglobin and albumin values decreased and food intake was associated with these deficiencies. Conditions that affected food intake most were pain related anxiety and stress related to surgery. The most common symptom was nausea one day after surgery, and constipation during three to five days after surgery. There was a negative correlation between food intake and nausea and constipation. Thus, it may be beneficial to raise the awareness of nurses in the nutrition of OHS patients to monitor patients' daily intake of foods in the perioperative period, to assess whether the amount of nutrient received meets the daily energy need, and to plan initiatives to encourage patients to take more nutrients.

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