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Macromineral intake and effect on hospitalization of patients in the orthopedic and traumatology ward

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Abstract

This study was carried out with the aim of investigating the correlation between nutrition and macromineral intake levels with hospitalization duration and complications among patients with orthopedic diagnoses. The sample for the study comprised 85 patients admitted to Tekirdağ Namık Kemal University Health Practices and Research Hospital Orthopedic and Traumatology ward with diagnosis of orthopedic disorders. Among patients, 17.7% had femur fracture, 12.9% had tibia/fibula fracture, 12.9% had foot/ankle fracture, 14.1% had arm fractures, 23.5% had arthroscopic surgery, 10.6% had knee prosthesis and 8.3% had hip prosthesis. Among patients, 47.1% had complications observed after hospitalization, while the reduction in loss of appetite and diarrhea complications as potassium intake increased was found to be statistically significant ($p<0.05$). Of patients, 94.12% had NRS 2002 score below 3, while 5.88% had NRS 2002 score of 3 and above and were at risk. It was identified that patients at risk for nutritional status had statistically significantly longer hospitalization ($p<0.05$). Male patients had statistically significantly more Ca, P, K and Fe consumption compared to women ($p<0.001$). Based on the results, nutritional programs planned by dietitians will contribute to shortening hospitalization duration and preventing malnutrition.

Keywords

Nutrition, Malnutrition, Complication, Orthopedics

Introduction

Nutrition involves the economic intake and use of the energy and nutrients required for a person to grow and develop and be able to live for a long duration as a healthy and beneficial individual, in sufficient amounts without disrupting health and losing nutritional value (Yılmaz and Özkan, 2007; Bannerman et al., 2016). Many factors may cause inadequate nutrition. Malnutrition was associated with medical complications like severe and recurrent infections in sections of society with low income level (Blössner et al., 2005; Macit and Akbulut, 2016).

Meeting the necessary food and fluid requirements plays an important role in preventing malnutrition in hospitals (Delmi et al., 1990; Bannerman et al., 2016). Malnutrition is frequently seen in cancer patients, geriatric patients and intensive care unit patients and the prevalence varies from 27 to 58% among orthopedic and traumatology patients (Lumbers et al., 2001; Bannerman et al., 2016; Lambert et al., 2017).

Protein intake provides the structural matrix of bone and affects bone density by elevating insulin-like growth factor-1 (IGF-1) levels and increasing intestinal calcium absorption. In this context, as a result of low protein intake protein providing the energy required by functional organs disrupts muscle mass and then bone

structure (Rosenberger et al., 2019; Torbergsen et al., 2019).

Mineral intake (especially calcium) is a factor that is a focus of importance in the healing process for orthopedic and traumatology patients as it plays an important role in the muscle-skeletal system (Moon et al., 2019; Torbergsen et al., 2019). Minerals are essential requirements for important functions in cell operations and the body. Calcium (Ca), phosphorus (P), potassium (K) and iron (Fe) lead the list of essential minerals for the body (Pagan, 2010; Baysal, 2014; Thandrayen and Pettifor, 2018).

Material and Methods

Research Universe-Sample

The universe for the research comprised patients attending Tekirdağ Namık Kemal University Health Practices and Research Hospital Orthopedic and Traumatology unit and admitted to the ward, who did not have one or more of the exclusion criteria of being pregnant or breastfeeding, lactose intolerant, or gastrointestinal system cancer diagnosis, were aged 18-65 years and volunteered to participate. The sample size for the study was found according to the formula $n=(t^2pq)/d^2$, with certain degrees of freedom and detected error d^2 level 1.96 from the theoretical value (t constant value) found in the t table and complication incidence of 5% for patients admitted to the orthopedics and traumatology ward as identified in previous research. For this reason, taking the incidence/probability of the investigated effect (p value) as 0.05, the incidence/probability of not observing the investigated effect (q value) as 0.95, and the desired ± deviation (d value) according to the event frequency as 0.05, a sample of 73 people was identified. The sample size for the study was planned as 80 people with 95% confidence interval and 80% power. The sample group for the research was reached from October 2020 to March 2021 and a total of 85 people abiding by the inclusion criteria participated in the study.

Measurement Methods used in the Research

The individuals included in the study were given information and read the Volunteer Consent Form. Then, the individuals abiding by the criteria had a survey applied by the researcher with the face-to-face interview method questioning demographic information, anthropometric measurements [height (cm), weight (kg), waist circumference (cm)] and nutritional habits.

The waist circumference of individuals was measured with a tape by the researcher. The 'Food Consumption Frequency Survey' was used showing the daily, weekly or monthly frequency and amounts for food/nutrient groups. If individuals stated amounts casually or did not state amounts on the 'Food Consumption Frequency Survey', it was not included in the study. Common portion sizes for each food (slice, piece, teaspoon, dessert spoon, tea glass, water glass, portion) were used. With the aim of visually explaining the portion amounts on the Food Consumption Frequency Survey, standard portion sizes and amounts for food groups in the 'Food and Nutrient Photograph Catalogue Measures and Amounts' were used. The data from the 'Food Consumption Frequency Survey' were assessed using the 'Nutritional Information System (BEBIS)' and the energy/nutrient amounts provided by each food were calculated.

NRS 2002 assessment was performed with the aim of identifying the nutritional status of individuals. The correlation of calcium, potassium, phosphorus and hemoglobin findings with nutritional status was investigated for individuals participating in the study. Calcium, potassium, phosphorus and hemoglobin measurements were performed using an autoanalyzer in Tekirdağ Namık Kemal University Health Practices and Research Hospital Biochemistry Laboratory according to the methods recommended in the guidelines for use of the device. Analysis results were obtained for all parameters, and patient files were used to determine complications during hospitalization and duration of hospitalization of patients.

Analysis of Data

Statistical analysis of research data was performed with IBM SPSS 23 (Statistical Package for Social Science-23). Assessment used basic statistical methods like mean, standard deviation, minimum and maximum values. Additionally, histograms, skewness-kurtosis, detrended graph and Kolmogorov-Smirnov normality test were used to check the fit of data distribution to normal distribution. Comparison of the means for data with normal distribution used the independent samples t test. Means in two groups without normal distribution were compared with the Mann Whitney U test. More than two groups were compared with the Kruskal Wallis variance analysis. The Pearson correlation analysis was applied to data sets with normal distribution. Spearman correlation analysis was used for data sets without normal distribution. Comparisons of percentages and rates used the chi-square and Fisher's exact test, while comparison of two numerical groups used the Mann Whitney U test. Results are given in the 95% confidence interval with significance level accepted as $p<0.05$.

Result and Discussion

The mean age of orthopedic patients was identified as 44.38±13.35 years. Mean age of female patients was 49.94±13.59, while mean age of male patients was 40.29±11.71 years. General information for individuals comprising the study sample can be seen in Table 1. In our study, the total of 85 patients comprised 49 men (57.65%) and 36 women (42.35%). A study in the orthopedic and traumatology clinic of an education and research hospital by Seller et al. (2015) observed 49.8% men and 50.2% women when the patient profile was investigated over a year. In our study, there were similarities to the results of the study.

When individuals are examined in terms of mean age, women were identified to be statistically significantly older compared to men ($p=0.001$). The mean BMI of all individuals participating in the study was 28.04±5.41 kg/m^2. Statistical significance was not observed between BMI values of cases ($p>0.05$). No one with BMI value below 18.5 kg/m^2 was identified among the patients. For male patients, 34.7% had normal weight, 42.9% were overweight and 22.4% were obese. For female patients, 25% had normal weight, 25% were overweight and 50% were obese. In terms of BMI groups, it was identified that 50% of female patients and 22.4% of male patients were obese, with women being more obese at statistically significant rates compared to men ($p<0.05$).

Chronic disease was present in 20.4% of male patients and 47.2% of female patients. Female patients

had relatively more chronic disease compared to male patients with statistical significance between the rates of chronic disease in women and men (p=0.002). In Turkey, it appears diabetes affects 10.5% of women and 9.3% of men, while cardiovascular diseases affect 13.5% of women and 11.8% of men (Ünal et al., 2013). Among female patients, 22.2% had diabetes and 36.1% had cardiovascular diseases, while for male patients, 10.2% had diabetes and 10.2% had cardiovascular diseases. The incidence of chronic disease and cardiovascular diseases in female patients was identified to be statistically significantly higher compared to male patients (p<0.05). A study by Fardellone et al., (2010) about patients with fractures identified that 10.2% of patients had diabetes and 29.6% had cardiovascular disease. Our study obtained results similar to studies in the literature.

The mean hospitalization duration of patients according to orthopedic and traumatology diagnoses are shown in Table 2. When the orthopedic diagnoses in our study are classified, 15 individuals (17.7%) had femur fracture, 11 individuals (12.9%) had tibia/fibula fracture, 11 individuals (12.9%) had foot/ankle fracture, 12 individuals (14.1%) had arm fractures, 20 individuals (23.5%) had arthroscopic surgery, 9 individuals (10.6%) had knee prosthesis and 7 individuals (8.3%) had hip prosthesis. When investigated according to hospitalization duration, the longest stay in hospital was for femur fracture patients who stayed 18.93±14.06 days, while the group with the shortest hospitalization were arthroscopic surgery patients who stayed 4.6±2.01 days. Arthroscopic surgery patients were hospitalized for shorter duration by a statistically significant degree compared to the hospitalization durations of other orthopedic groups (p<0.001). A study by Bee et al., (2013) of an orthopedic and traumatology department identified that 38 people (36.9%) had hip fracture, 8 people (7.8%) had arm fracture, 14 people (13.6%) had femur fracture, 10 people (9.7%) had foot/ankle fracture, 12 people (11.7%) had tibia/fibula fracture and 7 people (6.8%) had multiple injuries. Among orthopedic surgery patients, Bogunovic et al. (2010) observed that 6% had arm fractures, 16.4% had arthroplasty surgery, 13.2% had foot/ankle fracture, and 50% had multiple injuries.

Table 1. Distribution of Demographic Information of Individuals

	N (85)			Women n (36)		Men n (49)		
Age	44.38±13.35			49.94±13.59		40.29±11.71		Z=-3.373 p=0.001
				N(overall)		%		
18-33				22		25.9		
34-49				28		32.9		
50-65				35		41.2		
Sex								
Men				49		57.65		
Women				36		42.35		
		Mean (N=85)		Min-Max				
BMI mean		28.04±5.41		18.93-47.55		Z=-1.939 p=0.053		
BMI group		Men (n=49) S	%	Women(n=36) S	%	Overall (N=85) S	%	
Normal	17	34,7	9	25,0	26	30,6		x^2=7,130 p=0,028
Overweight	21	42,9	9	25,0	30	35,3		
Obese	11	22,4	18	50,0	29	34,1		
		Men (n=49)		Women (n=36)		Overall (N=85)		
	Mean	Min-max		Mean	Min-max	Mean		
Waist/Height	0.54±0.08	0.39-0.73		0.59±0.11	0.4-0.85	0.56±0.09	Z= -0.013	p=0.989
Waist/Height group	n	%		n	%	N	%	x^2=14.006 p=0.001
Normal (<0.5)	18	36.7		9	25.0	27	31.8	
Risky (0.5-0.6)	20	40.8		5	13.9	25	29.4	
Requires treatment (>0.6)	11	22.4		22	61.1	33	38.8	

Z= Mann Whitney U test x^2=Chi-squared test

Table 2. Evaluation of General Health Conditions of Patients

		Man (n=49) S	%	Women (n=36) S	%	Overall (N=85) S	%	
Chronic Diseases	Yes	10	20.4	19	47.2	29	34.1	x^2=9.674 p=0.002
	No	39	79.6	17	52.8	58	65.9	

Diagnosis	S	%	Mean	
Femur fracture	15	17.7	18.93±14.06	KW=33.714
Tibia/fibula fracture	11	12.9	16.09±11.18	p<0.001
Foot/ankle fracture	11	12.9	13.27±17.10	
Arm fracture	12	14.1	9.17±4.61	
Arthroscopic surgery	20	23.5	4.60±2.01	
Knee prosthesis	9	10.6	14.56±14.03	
Hip prosthesis	7	8.3	13.00±6.32	
Overall	85	100	12.13±11.57	

	Yes S	%	No S	%
Complications	40	47.1	45	52.9
Nausea	11	12.9	74	87.1
Vomiting	7	8.2	78	91.8
Loss of appetite	19	22.4	66	77.6
Fever	9	10.6	76	89.4
Infection	12	14.1	73	85.9
Diarrhea	7	8.2	78	91.8
Other	13	15.3	72	84.7

KW=Kruskal Wallis H-Test x^2=Chi-squared test

The mean hospitalization of patients with foot/ankle fractures was 13.27±17.10 days and the longest hospitalization was 64 days. Considering the mean hospitalization durations, patients with femur fracture had the longest hospitalization (18.93±14.06). The shortest hospitalization duration (days) was for arthroscopic surgery patients. Patients undergoing arthroscopic surgery had statistically significantly shorter duration of hospitalization compared to other patient groups in the orthopedic ward (p<0.001). A study by Gunningberg et al., (2008) found hip and knee prosthesis patients stayed in hospital 6.4±2.5 days, while orthopedic surgery patients stayed in hospital 7.0±1.9 days. In our study, similar to the literature, hospitalization durations were variable based on diagnosis groups.

In this study, complications observed in patients during their hospitalization were questioned. Complications were identified in 47.1% of patients. Among patients, 22.4% had loss of appetite and 12.9% had nausea. Other complications were present in 15.3% of patients with constipation in 6 people, continuous headache in 2 people and dizziness in 2 people. A study by Hendrickson et al., (2019) observed diarrhea and vomiting in 12 orthopedic and traumatology patient. When Khah et al., (2020) investigated postoperative complications among patients in the orthopedic and traumatology ward, 59.3% had nausea, 39% had vomiting and 98.4% had pain. When the complications observed among patients in this study are investigated, different results were obtained compared to literature studies with less nausea and vomiting in our study.

The hemoglobin (HGB) values of orthopedic and traumatology patients participating in the study were statistically significantly higher for male patients compared to female patients (p<0.001). The mean HGB value was identified as 12.80±2.07 g/dL for male patients and 8.65±0.53 g/dL for female patients (p<0.001). Patients with joint prosthesis were identified to have statistically significantly lower hemoglobin values compared to other orthopedic diagnostic groups (p<0.05). The assessment of differences in biochemical parameters according to sex of patients is shown in Table 3.

There were no significant differences in terms of serum Ca, K and P according to sex for patients included in the study (p>0.05). The relationship between the complications observed in the patients and the biochemical parameters was investigated and the results are shown in Table 4. Accordingly, there were weak levels and negative statistically significant correlations between observation of fever with serum calcium, potassium, phosphorus and hemoglobin values in patients. There were negative, weak level statistically significant correlations between other complications with serum calcium, phosphorus and hemoglobin values (r=-0.261 p=0.016; r=-0.236 p=0.029; r=-0.300 p=0.005, respectively).

Koltka et al., (2004) investigated HGB values in patients undergoing major orthopedic surgery and found values of 12.11±1.32 g/dL in the 1st group and 12.02 ± 1.63 g/dL in the 2nd group. In our study, the hemoglobin values of male patients were similar to the results. There was a statistically significant and weak correlation

identified between the increase in fever among patients with falls in serum Ca, K, P and HGB ($p<0.05$). Similarly, a weak correlation was found at statistically significant levels between reductions in serum Ca, P, and HGB values with increasing complications ($p<0.05$). Binkley et al., (2017), in a study of total joint prosthesis patients, found hemoglobin was 13.6 g/dL and serum calcium was 9.1 g/dL related to bone health on the first day postoperative and no complications were observed in any patient. There is a need for more research about the relationship between biochemical parameters affecting bone health and complications.

Table 3. Biochemical Findings of Patients

	Men (n=49) Mean	Women (n=36) Mean	Overall (N=85)		
HGB* (g/dL)	12.80±2.07	11.01±1.50	12.04±2.05	t= 4.408	p<0.001

	Lower Extremity Fracture (n=36)		Upper Extremity Fracture (n=12)		Arthroscopic Surgery (n=20)		Joint Prosthesis (n=17)		Overall (N=85)		
Classification of Hemoglobin	S	%	S	%	S	%	S	%	S	%	
Low	21	58.3	7	58.3	5	25	14	82.4	47	55.3	x^2=12.640
Normal	15	41.7	5	41.7	15	75	3	17.6	38	44.7	p=0.005

t= Independent Samples T-Test x^2=Chi-squared test

Table 4. The Relationship Between Complications in Patients and Their Biochemical Parameters

	Complication		Fever		Other Complication	
	r	p	r	p	r	p
Calcium (mg/dL)*	0.001	0.996	-0.297	0.006	-0.261	0.016
Potassium (mmol/L)*	-0.074	0.502	-0.216	0.047	-0.023	0.835
Phosphorus (mg/dL)**	-0.129	0.241	-0.283	0.009	-0.236	0.029
HGB (g/dL)*	-0.185	0.09	-0.226	0.038	-0.300	0.005

*Pearson's correlation coefficient **Spearman's rank correlation coefficient

The hospitalization duration of 5 patients at risk in terms of nutritional status was 26±17.34 days, while the hospitalization duration of 80 patients not at risk for nutritional status was identified as 11.26±10.69 days. The hospitalization duration of those at risk for nutritional status was identified to be statistically significantly longer ($p<0.05$).

Correia and Waitzberg, (2003) investigated hospitalization duration and malnutrition in their study and found those with nutritional risk stayed 16.7±24.5 days, while those without nutritional risk stayed 10.1±11.7 days. In our study, similar to the study by Correia and Waitzberg, the hospitalization duration of patients with nutritional risk was identified to be longer. A study by Olofsson et al., (2007) of 157 patients with lower extremity fracture found no statistically significant correlation between malnutrition scores and BMI of female patients and male patients. In our study, different to Olofsson et al., (2007), there was a negative and significant correlation between BMI and NRS 2002. Different to the literature, malnutrition was identified to be lower in this study. Impaired function, various diseases, the use of some drugs, dementia, and eating/chewing problems were usually associated with malnutrition (Tamura et al., 2013).

A study by Michaelsson et al., (2014) investigated the fracture risk of those consuming less than 1 glass of milk per day (<200 g), 1-2 glasses (200-399 g), 2-3 glasses (400-599 g) and more than 3 glasses (≥600 g). Lower fracture risk was not identified with higher milk consumption by women and men. A meta-analysis study by Bischoff-Ferrari et al., (2011) found milk intake in women was not generally associated with hip fracture risk; however, they determined there was a need for more data about male patients. There was no correlation found between total milk intake and hip fracture risk. The results obtained in the present study overlap with the findings of studies in the literature.

Table 5 shows the mean hospitalization (days) according to NRS 2002 scores of patients during hospitalization. Patients at risk in terms of nutrition according to NRS 2002 (≥3) had mean hospitalization duration of 26.00±17.34 days, while patients not at risk in terms of nutrition (<3) had hospitalization duration of 11.26±10.69 days. When these values are compared, those at risk in terms of nutrition remained in hospital for significantly longer ($p<0.05$).

Table 5. The Average Duration of Hospitalization of Patients According to the NRS-2002 Classification of Hospitalization (day)

Average lenght of stay (day)	S	%	Mean	Z	p
Nutritional status not at risk (<3)	80	94.12	11.26±10.69		
Nutritional status at risk (≥ 3)	5	5.88	26.00±17.34	-2.368	0.018

Z= Mann-Whitney U test

There were positive and weak correlations between incidence of vomiting and nausea with NRS 2002 points of patients included in the study (r=0.289, p<0.01; r=0.350, p=0.001, respectively). There were no significant correlations found between other complications of loss of appetite, fever, infection, diarrhea and others with NRS 2002 points (p>0.05). A study by Lumbers et al. (2001) identified that HGB values were 11.2 g/dL for those with NRS score 3 and above, while it was 13.2 g/dL for those with NRS 2002 score below 3. There was a significant correlation observed between the need for nutritional support with low HGB. In this study, results similar to this study.

Male patients had mean energy intake of 2316.66±780.68 kcal while female patients had mean energy intake of 1596.43±614.73 kcal according to the food consumption frequency (Table 6). In this situation, the mean energy consumption (per day) of men was identified to be statistically significantly higher compared to women (p<0.001). When protein consumption is investigated, mean protein consumption was 103.24±31.8 g for male patients and 73.38±23.96 g for female patients. In this situation, the mean protein consumption (per day) of male patients was found to be statistically significantly higher compared to female patients (p<0.001).

Table 6. Average Energy and Other Nutrient Consumption Status of Patients According to the Food Consumption Frequency Questionnaire

		Erkek (n=49)	Kadın (n=36)	
Energy (kcal)	Ortalama	2316.66±780.68	1596.43±614.73	Z=-4.287 p<0.001
	Min-Max	1102.4-4402	707.3-3116.7	
Protein (g)	Ortalama	103.24±31.8	73.38±23.96	Z=-4.367 p<0.001
	Min-Max	55.7-191.4	30.0-135.2	
Carbohydrate (g)	Ortalama	284.25±129.6	191.36±108.2	Z=-3.300 p=0.001
	Min-Max	101.2-630.7	44.8-474.5	
Fat (g)	Ortalama	81.73±33.54	57.11±21.39	Z=-3.789 p<0.001
	Min-Max	33.1-195.5	23.4-110.4	

Mann Whitney U test

As inadequate nutrition is a potentially changeable risk factor related to increasing hospital costs, complications and hospitalization duration, in this study the degree to which daily needs of individuals were met was investigated. When the energy and macronutrient consumption status of individuals is investigated, male patients were identified to consume mean 2316.66 kcal/day, while female patients consumed mean 1596.43 kcal/day. For male patients, this energy came from 49.5% carbohydrates, 18.1% protein and 32.4% fat; for female patients, this energy came from 48.6% carbohydrates, 18.8% protein and 32.6% fat. In this situation, the mean energy, carbohydrates, protein and fat consumption (per day) of male patients was found to be higher by a statistically significant degree compared to female patients (p<0.001). Rosenberger et al., (2019) did not identify a statistically significant difference between energy and protein intake with sex in a study of the orthopedic and traumatology ward. In our study, different to this study, there was a significant difference identified between energy intake of male and female patients.

In this study investigating complications observed in patients along with macronutrient intake, a statistically weak but significant difference was observed for a reduction in diarrhea with diets rich in protein and fat (p<0.05). There was no significant correlation observed between energy status and carbohydrate consumption with complications. In the study by Correia and Waitzberg (2003), patients with inadequate energy and protein intake appeared to have greater risk of infection. A study by Delmi et al., (1990) identified fewer complications among those fed with diets rich in energy and protein. There are studies obtaining results contrary to the findings we obtained in our study (energy intake) (Correia and Waitzberg, 2003; Delmi et al., 1990). Similarly to studies in the literature, patients with a diet rich in protein were identified to have reductions in some complications (loss of appetite and diarrhea). Proteins are vital substances which make good the wear and tear of tissues and supply the building materials for the body (De et al., 2019).

When micronutrient consumption of patients is investigated according to the food consumption frequency survey, calcium consumption was 1024±371.85 mg/day for male patients and 754.72±306.2 mg/day for female patients (p=0.001) (Table 7). The phosphorus consumption for male patients was 1653.5±453.05 mg/day while for female patients it was 1169±395.2 mg/day; potassium consumption was 3437.67±910.33 mg/day for men and 2491.33±795.44 mg/day for women; and iron consumption was 13.94±3.75 mg/day for men and 9.34±33 mg/day for women. Male patients were determined to consume more potassium, phosphorus and iron by a statistically significant degree compared to female patients (p<0.001).

In this study investigating the micronutrient consumption of patients with food consumption frequency, calcium, phosphorus, potassium and iron consumption were higher at statistically significant levels for male patients compared to female patients (p<0.001). A cohort study by Cumming et al. (1997) investigated the correlation between calcium consumed in diet with hip (n=332), foot/ankle (n=210), proximal humerus (n=241), wrist (n=467) and shoulder (n=389) fracture and identified that 34% of patients ate a calcium-rich diet, while 66% ate a calcium-poor diet. In our study,

female patients were identified to have low calcium consumption, similar to the literature.

Table 7. Micronutrient Consumption Status of Patients According to the Food Consumption Frequency Questionnaire

		Man (n=49)	Women (n=36)	
Calcium (mg)	Mean	1024.39±371.85	754.72±306.2	Z=-3.460 p=0.001
	Min-Max	453.4-2235.3	320.3-1532.3	
Phosphorus (mg)	Mean	1653.5±453.05	1169.93±395.2	Z=-4.732 p<0.001
	Min-Max	774.92-2679.8	438.1-2417.8	
Potassium (mg)	Mean	3437.67±910.33	2491.33±795.44	Z=-4.527 p<0.001
	Min-Max	1704.6-5524.13	1386.4-4835.05	
Iron (mg)	Mean	13.94±3.75	9.34±3.3	Z=-5.047 p<0.001
	Min-Max	6.75-21.26	4.13-17.96	

Mann Whitney U test

Negative and weak levels of correlation were identified between the protein consumption, a macro nutrient, of patients with loss of appetite and diarrhea (r=-0.223 p=0.04; r=-0.253 p=0.02, respectively). There was a negative and weak correlation between fat consumption and diarrhea (r=-0.249, p=0.021). There were negative and weak correlations between omega 3 and omega 9 consumption with loss of appetite and diarrhea (r=-0.245 p=0.024; r=-0.287 p=0.008, respectively). Similarly, there were negative and weak levels of correlation between omega 9 consumption with loss of appetite and diarrhea (r=-0.244 p=0.024; r=-0.228 p=0.035, respectively).

When the relationships between complications observed in patients and the micronutrients consumed by patients are investigated, with the increase in potassium consumption there were statistically significant reducing trends in the observation of loss of appetite and diarrhea (r=-0.224 p=0.039; r=-0.216 p=0.047, respectively). Duan et al., (2019) reported that prosecretory mechanism for diarrhea involving amplified activity of K+ channels at the basolateral membrane of intestinal epithelial cells at the apical membrane. In our study, there was no significant correlation encountered between the consumption of calcium, phosphorus and iron with complications for patients with orthopedic diagnosis (p>0.05). The study by Hendrickson et al., (2019) identified a weak correlation between nutrition poor in iron with increasing complications. Contrary to the study by Hendrickson et al., (2019), in our study no correlation was identified between iron consumption and complications. A study of geriatric orthopedic patients by Groenendikj et al., (2020) found mean calcium, vitamin D, potassium, magnesium and selenium intakes were significantly below the recommended amounts. In our study, similar to the study by Groenendijk et al., (2020), mineral intake was identified to be inadequate.

Conclusion

The results of this study show adequate and balanced nutrition affects duration of hospitalization.

As seen in this study, anthropometric measurements like BMI, waist circumference, and waist/height ratio of patients should be continuously monitored. However, the nutritional status of individuals should be identified for the detection and monitoring of malnutrition not just with anthropometric measurements but using biochemical parameters, food consumption records of patients and nutritional scoring methods like NRS 2002. In this way, more effective medical nutritional treatment may be administered to patients.

Compliance with Ethical Standards

Conflict of interest

The authors declared that for this research article, they have no actual, potential or perceived conflict of interest.

Author contribution

This study was produced from a master's thesis. Author of the thesis: Beydanur Nizam, Thesis advisor: Asst. Prof. Dr. Nazan Tokatlı Demirok, Tekirdağ Namık Kemal University, Institute of Health Sciences, 2021.

Conceptualization; B.N., methodology; B.N., and N.T.D., formal analysis; B.N., N.T.D., A.S., B.G., M.Ü.Ç., validition; B.N., investigation; B.N. and N.T.D., supervision; B.N., writing-original draft; B.N., N.T.D., A.S., and B.G., writing-review and editing; B.N., N.T.D., A.S., B.G., M.Ü.Ç. All the authors read and approved the final manuscript. All the authors verify that the Text, Figures, and Tables are original and that they have not been published before.

Ethical approval

This research was conducted in accordance with the principles of the Declaration of Helsinki. For the research, permission was obtained from the Namık Kemal University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee, dated 04.02.2020 and numbered 2020.13.01.13.

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Data availability

Not applicable.

Consent for publication

Not applicable.

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