Undernutrition and Associated Factors among Admitted Adult Surgical Patients in Harar, Eastern Ethiopia

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Abstract

Background: Undernutrition in surgical patients is found to be associated with reduced wound healing, increased complication rates, length of hospital stay, mortality, and healthcare costs than normally nourished patients. However, there is no enough evidence in Ethiopia that demonstrates how serious the issue is among adult patients. Therefore, this study aimed to assess the magnitude of undernutrition and associated factors among admitted adult surgical patients in Harar, eastern Ethiopia.

Methods: Hospital-based cross-sectional study was conducted among 398 admitted surgical patients in Jugal General Hospital and Hiwot Fana Comprehensive Specialized University Hospital from December 20, 2018, to November 30, 2019. A structured questionnaire was used to collect socio-demographic information. Anthropometric measurements and dietary diversity assessment were made at admission and discharge of the patient. The nutritional status of patients was determined by Body Mass Index. Data were analyzed using Statistical Package for the Social Sciences version 20 software. Logistic regression analysis was performed to assess factors associated with nutritional status at the time of admission and discharge.

Results: A total of 87(21.9%) (95% CI: 17.9, 26.2) and 99 (24.9%) (95% CI: 20.7, 29.4) study participants were underweighting at admission and discharge, respectively. Being in age groups 18-40 years (AOR=0.26; 95%CI: 0.09, 0.66) and 41-60 years (AOR=0.23; 95% CI: 0.09, 0.54) and urban residence (AOR= 0.37; 95%:0.18, 0.76) were significantly associated with underweight at admission. Being male (AOR= 0.39; 95% CI: 0.20, 0.76), age groups 18-40 (AOR= 0.14; 95 % CI 0.04, 0.52) and 41-60 years (AOR=0.15; 95% CI: 0.04, 0.52), urban residents (AOR=0.26; 95%CI: 0.11, 0.57), those with the elective type of surgery (AOR=0.34; 95% CI: 0.14, 0.82), hospital stay less than 5 days (AOR=0.14; 95% CI: 0.02, 0.69) were found to be significantly associated with underweight at discharge.

Conclusion: Undernutrition was high among surgical patients. Therefore, hospitals should apply nutritional assessment and nutritional counseling/support to surgically admitted patients considering the identified factors.

Keywords: Undernutrition; adult; surgical patients; Harar; eastern Ethiopia

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Introduction

Malnutrition is a situation in which insufficiency, excess, or imbalance of energy, protein, and other nutrients causes considerable adverse effects on tissue/body's form and function, and clinical outcome. It is used to describe both over and undernutrition considering both macronutrients (carbohydrates, proteins, and fats) and micronutrients (vitamins and minerals). Undernutrition is mainly used in the context of deficient energy or protein intake or absorption and is often described as protein-energy malnutrition (Leistra, 2015).

Undernutrition is rampant around the world which is a burden on patients and healthcare facilities. Studies reported that up to 40% of patients are undernourished at the time of their admission and the majority of them continued to be nutritionally depleted throughout their hospital course. Surgery-related causes of undernourished are due to hypercatabolism, postoperative fasting, fistula, mal-absorption syndrome, and intestinal obstruction (Shpata *et al*., 2014; Leandro-Merhi *et al*., 2010; Saunders and Smith, 2010).

Undernourished patients have higher morbidity and mortality rates than normally nourished patients, with longer stays in hospital and increased health care costs. A study conducted in Singapore found that the magnitude of malnutrition at admission was 29%. The undernourished patients had longer hospital stays (6.9 ± 7.3 days vs. 4.6 ± 5.6 days) and were more likely to be readmitted within 15 days (Edington *et al*., 2000). Another study report from German found a 27% rate of malnutrition among hospitalized patient.

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Undernourished patients have a length of hospital stay of 43% longer than well-nourished patients (Pirlich *et al*., 2006).Being undernourished is also found additionally associated with reduced wound healing and increased complication rates. Lack of appropriate nutritional support during hospitalization may worsen patients' nutritional status and increases the risk of infection, organ failure, and suboptimal response to regular medical treatment (Mahakalkar *et al*., 2013).

The nutritional status of hospital-admitted patients is compounded by primary malnutrition mainly reflecting poor social-economic conditions and secondary undernourished reflecting usually the impact of degenerative and chronic diseases (Shpata *et al*., 2014). The treatment of undernourished first requires identifying the patient as undernourished using nutrition screening or another assessment tool at admission. A healthcare team should make this procedure compulsory (Meijers *et al*., 2009).

The presence of infection, non-communicable diseases, old age, length of hospital stay, marital status, education level, weight loss, and individual dietary diversity score were the identified factors affecting undernutrition among adult hospitalized patients (Correia et al., 2001; Fang *et al*., 2013; Garcia *et al*., 2013; Haile *et al*., 2015).

The issue of undernutrition and intervention among adult patients is well-studied in other parts of the world (Leandro-Merhi et al., 2010; Álvarez-Hernandez et al., 2012; Garcia *et al*, .2013). However, the magnitude of malnutrition among hospital-admitted patients in Ethiopia was not widely known and neglected. There are no enough studies carried out in the country to substantiate the need for nutritional screening and intervention in adult patients. Therefore, this study tried to assess the magnitude of undernourished and associated risk factors among surgical patients in public hospitals in Harar, eastern Ethiopia.

Materials and Methods

Study setting, design, and period

An institutional-based cross-sectional study was conducted in the two public hospitals in the Harari National Regional state from December 20, 2018, to November 30, 2019. Harar is the capital city of Harari National Regional state, which is one of the eleven regional states of the Federal Democratic Republic of Ethiopia and located in the East part of Ethiopia at a distance of 515km from Addis Ababa. The region has 8 districts and 36 kebeles (17 rural and 19 urban). Harar town is divided into 19 kebeles. There are four governmental hospitals, two private hospitals, and four health centers in the town (Harari region 2010). The expected number of surgical admissions at Hiwot Fana specialized university hospital was 70 per month, while 25 at Jugal General Hospital.

Population, Inclusion/ Exclusion Criteria

All patients older than the age of 18 years admitted to a surgical ward and stayed in the ward for at least 24 hours were included in the study. Because it is difficult to look at how admission affects the nutritional status of patients with less than 24 hours of admission. Those patients having difficulty communicating and understanding, severe deformity, edematous, pregnant women, difficulty speaking (in a coma) or unconscious, underwent minor surgery, and were discharged before 24 hours, with recent surgery were excluded from the study. In addition, those patients readmitted again for another surgery who might have high malnutrition associated with previous surgery, were also excluded from this study.

Sample size determination and sampling technique

The sample size was calculated using EPINFO version –software considering assumptions of power of 80%, ratio unexposed: Exposed of 1:1; the prevalence of malnutrition among not read and write (61.5%) and literate (48.5%) in the study conducted among adult hospitalized patients at Amhara National Regional State, Ethiopia (Haile *et al*., 2015) and 5% non-response rate. The final sample size for this study was 410. The final Sample size was allocated proportionally based on the average number of patients admitted to the surgical ward in each hospital per month. Then all consecutive eligible patients were included from each hospital. Hiwot Fana specialized university hospital and Jugal General Hospital had 70/month and 25/month surgical admission respectively. A total of 302 and 108 patients were included in this study from Hiwot Fana specialized university hospital and Jugal General Hospital, respectively.

Data Collection Techniques

Data were collected by the following methods:

Face-to-face interview: was made by trained BSc degree in nursing data collectors using a pre-tested structured questionnaire which was prepared by reviewing related literature (Haile *et al*., 2015; Correia *et al*., 2001). The questionnaire was used to collect data on socio-demographic information such as age, occupation, education, income, type of transport, and distance to the hospital. In addition, clinical information from patient records such as the current type of disease diagnosed and comorbidity, duration of current disease, previous history of surgery, complications after surgery, and type of surgery were reviewed. After completion of the above data collection process during admission, study participants were followed till discharge from the hospital.

Nutritional status assessments: were conducted at the time of admission and discharge. The weight (W) of patients was measured using a scale with a maximum capacity of 150 kg and an accuracy of 0.1 kg. Participants were instructed to make minimum clothing and bare feet during the procedure. The weighting scale was checked for correctness after each patient measured against known weight. Height (H) was measured in a standing position using a stadiometer. Patients were measured with their heads straight ahead, their heels together, and without shoes. But for those confounded to bed, demi-span (outstretched arms, forwarded palm from the base of the middle finger to the sterna notch), knee height, and ulnar length were used (Haile *et al*., 2015). The above measurements were taken in duplicates and an average was used in the measurement.

Body Mass Index (BMI) (kg/m2) was calculated by dividing the weight by the square of the height (kg/m2). It was classified according to the World Health Organization (WHO) criteria (WHO. 1998) for adults, BMI < 18.5 kg/m2 = Underweight; 18.5 kg/m2 ≤ BMI ≤ 24.9 kg/m2 = Normal; 25 kg/m2 ≤ BMI ≤ 29.9 kg/m2 =Overweight; BMI ≥ 30 kg/m2 = Obese. The BMI for elderly patients (60 years or older) was classified according to Lipschitz (Lipschitz, 1994). BMI ≤ 22 kg/m2 = underweight; 22 kg/m2 < BMI < 27 kg/m2 =Normal; BMI ≥ 27 kg/m2 = Overweight and BMI ≥ 30 kg/m2 =Obese.

Waist circumference (WC) was measured on the median line between the costal border and the iliac crest at the end of exhalation. According to International Diabetes Foundation (IDF), WC was transformed into dichotomous variables: higher than 94 cm for men or 80 cm for women was considered at risk for chronic disease and under that no risk (International Diabetes Federation,2005; WHO, 2008).

Dietary diversity assessment: was made by using a standard dietary diversity questionnaire at admission and at the time of discharge. The 12 food groups: cereals; white roots and tubers; vegetables; fruits; meat; eggs; fish and seafood; legumes, nuts, and seeds; milk and milk products; oils and fats; sweets; spices, condiments, beverages were used for dietary diversity assessment (FAO. 2007).

Hemoglobin test: blood was collected through finger puncture and hemoglobin was measured using a HemoCue hemoglobin analyzer (HemoCue® Hb 301).

Operational Definition

Dietary diversity: Individual Dietary Diversity Score was calculated as the sum of the 12 food groups consumed over 24 hours. By considering the mean individual dietary diversity score, participants with an Individual Dietary Diversity Score above the mean were considered as good dietary diversity (diversified diet) or high and those below the mean Dietary Diversity Score were considered as low dietary diversity (undiversified diet) or low (FAO. 2007).

Anemia: was defined for non-pregnant women (18 years of age and above) and men (18 years of age and above) with hemoglobin values of < 11 g/dl and < 12 g/dl, respectively (WHO, 2011).

Length of hospital stay was measured in days, from the day of admission to the hospital to the time of discharge or death

Data Processing and Analysis

Data were coded and entered using Epi Data software version 3.1 and transferred to SPSS version 20 software packages for analysis. A descriptive analysis of the patients was done by calculating the mean, standard deviation, and proportion of the studied variables. Dichotomous variables were expressed as percentages. The chi-square test was used to compare the proportions. The student t-test was used to compare the mean of weight gain or loss at hospital admission and

discharge. Bivariate and multivariate logistic regression analysis was performed to assess factors associated with nutritional status at the time of admission and discharge. Variables with a p-value less than 0.25 were considered for multivariate analysis. Those variables with p values less than 0.05 in multivariate analysis were considered as significantly associated factors.

Quality Control

Two days of training were given for data collectors and first-degree holder public health officers. The questionnaire was first prepared in English then translated into the local language and back-translated to English to maintain the consistency of the questionnaire. Data collection instruments were pre-tested on 5% of the study participants at Dil Chora Hospital and appropriate modifications were made. All the anthropometric measurements and hemoglobin measurements were done following standard operating procedures. Daily supervision, spot checking, and reviewing completed questionnaires were conducted to follow for completeness and consistency of the data by the supervisors.

Ethical Consideration

Ethical clearance for the study was obtained from the Institutional Health Research Ethics Review Committee (IHRERC/156/2017) of Haramaya University. Written and signed informed consent were obtained from each study participant. Information obtained during the study was kept confidential and only intended for research purposes. Names or any identifiers of study participants were not collected. The study participants' clinical records were reviewed anonymously and kept confidential information of clinical records was reviewed.

Results

Socio-Demographic Characteristics of Participants

A total of 398 study participants were included in this study with a response rate of 97.1%. The majority 293(73.6%) of them were from Hiwot Fana Specialized University Hospital. The mean age of the study participants was 35.6 (SD±15.5) years and 279(70.1%) of them were in the range of 18-40 years. Most of the study participants were male 263(66.1%) and rural residents 231 (58%). One hundred sixty-five (41.5%) and 142(35.7%) of the participants were unable to read and write and farmers in their occupational status, respectively. The majority 322 (88.4%) of the participants earn <3000 Ethiopian birrs per month (Table 1).

Clinical Characteristics of the Patients

The majority 289 (72.6%) of the study participants have current diseases of < 2 weeks duration. Only 30 (7.5%) of participants had a history of surgery. A total of 215(54.0%) and 183 (46%) were on emergency and elective surgery, respectively. Forty-three (10.2%) of study participants had co-morbidities other than the current disease they admitted. Diabetes mellitus was the commonest co-morbidity followed by hypertension. Sixty-two (15.6%) patients developed complications after surgery and surgical site wound infection was the commonest complication followed by sepsis. The median length of stay in the hospital was 9.3 days and the majority 307 (77.1%) of them stayed 5-15 days. The mean hemoglobin concentration was 12.7 (SD±1.9) g/dl. Most of the study participants were admitted due to digestive tract diseases 158 (39.7%) and trauma 116 (29.1%) (Figure 1). Three hundred ninety-two (98.5%) study participants were healed while 6 (1.5%) of the patients were referred out at the time of discharge.

Table 1. Socio-demographic characteristics of surgical patients admitted in Hiwot Fana Specialized University Hospital and Jugel, Hospital, 2019

Characteristics		Frequency	Percent
Age	18-40	279	70.1
	41-60	85	21.4
	>60	34	8.5
Residence	Urban	167	42.0
	Rural	231	58.0
Marital status	Married	256	64.3
	Divorced	5	1.3
	Widowed	12	3.0
	Unmarried	125	31.4
Educational status	Not able to read and write	165	41.5
	Able to read and write	104	26.1
	Primary (Grade 1-8)	65	16.3
	Secondary (9-12)	37	9.3
	College and above	27	6.8
	Farmer	142	35.7
	Housewife	60	15.1
	Government employed	25	6.3
	Merchant	60	15.1
	Daily laborer	23	5.8
	Students	65	16.3
	Other*	23	5.8
Monthly income(n=364)	<1000	145	39.8
	1000-3000	177	48.6
	3001- 5000	42	11.6

**Others: street dwellers, retired, drivers, homemade, jobless, barbers,*

Table 2: Clinical characteristics of surgical patients admitted to Hiwot Fana Specialized University Hospital and Jugel General Hospital, 2019.

Characteristics		Frequency	Percent
Duration of disease	<2 weeks	289	72.6
	≥2-4 weeks	109	27.4
History of surgery	Yes	30	7.5
	No	368	92.5
Co-morbidity	No-co-morbidity	355	89.2
	Diabetes Mellitus	19	4.8
	Hypertension	13	3.3
	Hypothyroidism	2	0.5
	Coagulopathy	5	1.3
	Malaria	1	0.3
	HIV	1	0.3
	Psychoses	2	0.5
Complication after surgery	Not at all	336	84.4
	Sepsis	18	4.5
	Pneumonia	7	1.8
	Urinary tract infection	4	1.0
	Wound Infection	33	8.3
Length of Hospital stay	<5 days	57	14.3
	5-15 days	307	77.1
	>15 days	34	8.5

Support and Dietary Diversity

About 258 (64.8%) of the study participants reported that they got support from relatives, friends, or neighbors during their admission and the majority 234 (90.7%) of them obtained support from their relatives. Nutrition support 174 (67.7%) was the commonest type of support. About 43.5% (31/398) of those who did surgery obtained nutritional counseling support during their hospital stay. Two hundred seventy-three (68.6%) and 149 (37.4%) study participants had low dietary diversity scores at admission and discharge, respectively (Table 3).

Nutritional Status at Admission and Discharge

The mean weight of the study participants at admission and discharge was 57.7 (SD±10.5) and 57.4 (SD±10.6). The mean BMI of the study participants during admission and discharge was 21.1(SD±3.3) and 21(SD±3.4), respectively (P<0.20). From 398 admitted patients, 87(21.9%) (95% CI: 17.9, 26.2) and 99 (24.9%) (95% CI: 20.7, 29.4) were undernourished at admission and discharge, respectively. A total of 42 (10.6%) (95% CI: 7.7, 14.0) and 48(12.1%) (95 % CI: 9.0, 15.7) study participants had the risk of chronic disease during admission and discharge based on waist circumference measurement, respectively (Table 4).

Table 3: Support and dietary diversity among admitted surgical patients in Hiwot Fana Specialized University Hospital and Jugal General Hospital, 2019.

Characteristics		Frequency	Percent
Who gave the support (n= 258)	Relative	234	90.7
	Friends	20	7.8
	Neighbors	4	1.6
Type of support got (n=258)	Nutrition	174	67.7
	Medication	11	4.3
	Counseling	5	1.9
	Nutrition and Medication	18	7.0
	Nutrition and Counseling	26	10.1
	Nutrition, Medication, and counseling	20	7.8
	Money	4	1.6
Nutritional counseling support before two weeks of admission for those with elective surgery (n=183)	Yes	30	16.4
	No	153	83.6
Nutritional counseling support during hospital stay (n= 398)	Yes	173	43.5
	No	225	52.5
Dietary diversity at admission	Low	273	68.6
	High	125	31.4
Dietary diversity at discharge	Low	149	37.4
	High	249	62.6

Table 4. Anthropometric measurements of surgical patients admitted in Hiwot Fana Specialized University Hospital and Jugel General Hospital, 2019.

Anthropometric measurements		At admission No. (%)	At discharge No. (%)	P-value
Mean weight		57.7(SD±10.5)	57.4(SD±10.6)	P<0.001
Mean BMI		21.1(SD±3.3)	21(SD±3.4)	P<0.200
BMI	Underweight	87 (21.9)	99(24.9)	P<0.310
	Normal weight	278(69.8)	264(66.3)	P<0.290
	Overweight	28(7.0)	28(7.0)	P<0.990
	Obese	5(1.3)	7(1.8)	P<0.560
Waist circumference	< 94cm for males, < 80 cm for females	356 (89.4)	350(87.9)	P<0.500

Factors Associated with Undernutrition at Admission

A total of 365 participants were included in the bivariate and multivariate logistic regression to assess undernutrition at admission after the overweight and obese patients were excluded (Table 5). The odds of undernutrition were 0.26 times (AOR=0.26; 95% CI: 0.09, 0.66) lower among patients in the age group18-40 years of age and 0.23 times (AOR= 0.23; 95% CI: 0.09, 0.54) lower among patients in the age group 41-60 years compared to those patients >60 years of age. The odds of undernutrition were 0.37 times (AOR= 0.37; 95% CI: 0.18, 0.76) lower among patients from urban areas compared to those patients from rural areas (Table 5).

Factors Associated with Undernutrition at Discharge

A total of 363 participants were included in the bivariate and multivariate logistic regression to assess undernutrition at discharge after the overweight and obese patients were excluded (Table 6). The odds of undernutrition were 0.39 times (AOR= 0.39; 95% CI: 0.20, 0.76) lower among male patients compared to females. The odds of undernutrition were 0.14 times (AOR= 0.14; 95% CI: 0.04, 0.52) lower among patients in the age group18-40 years and 0.15 times (AOR=0.15; 95% CI: 0.04, 0.52) lower among patients in the age group 41-60 years compared to those patients >60 years of age. The odds of undernutrition were 0.26 times (AOR=0.26; 95% CI: 0.11, 0.57) lower among patients from urban areas compared to those from rural areas. The odds of undernutrition were 0.34 times (AOR=0.34; 95% CI: 0.14, 0.82) lower among those patients who underwent an elective type of surgery compared to those patients who underwent emergency surgery. The odds of undernutrition were 0.14 times (AOR=0.14; 95 % CI: 0.02, 0.69) lower among those patients who stayed in the hospital for < 5 days compared to those who stayed more than 15 days (Table 6).

Table 5. Factors associated with undernutrition at admission among surgical patients in Hiwot Fana Specialized University Hospital and Jugal General Hospital 2019 (N=365)

Variables		Nutritional status		COR at 95%CI	AOR at 95%CI
		Under nourished No (%)	Normal No. (%)		
Hospitals	HFSUH	71(25.8)	204(74.2)	1.61(0.88, 2.94)	1.54(0.67, 3.64)
	Jugel	16(17.8)	74(82.2)	1	1
	18-40	58(22.1)	205(77.9)	0.27(012, 0.57)	0.26(0.09, 0.66)
Age	41-60	13(18.3)	58(81.7)	0.21(0.08, 0.53)	0.23(0.09, 0.54)
	>60	16(51.6)	15(48.4)	1	1
Residence	Urban	17(12.0)	125(88.0)	0.29(0.16, 0.53)	0.37(0.18, 0.76)
	Rural	70(31.4)	153(68.6)	1	1
Educational status	Not able to read and write	43(28.1)	110(71.9)	1.79(0.83, 3.88)	0.83(0.30, 2.28)
	Able to read and write and primary	34(21.8)	122(78.2)	1.28(0.58, 2.80)	0.88(0.33, 2.29)
	High school and above	10(17.9)	46(82.1)	1	1
	<1000	37(26.2)	104(73.8)	1.38(0.55, 3.45)	1.49(0.48,4.59)
Monthly income	1000-3000	33(20.8)	126(79.2)	1.01(0.40, 2.52)	1.26(0.43, 3.73)
	3001- 5000	7(20.6)	27(79.4)	1	1
Duration of disease	<2 weeks	57(21.3)	211(78.7)	0.60(0.35, 1.01)	0.82(0.45, 1.57)
	>2-4 weeks	30(30.9)	67(69.1)	1	1
History of surgery	Yes	7(33.3)	14(66.7)	76.7(0.64, 4.22)	2.31(0.68, 7.82)
	No	80(23.3)	264(76.7)	1	1
Co-morbidity	Yes	9(25.0)	27(75.0)	1	1
	No	78(23.7)	251(76.3)	0.93(0.42, 2.06)	0.77(0.27, 2.22)
	Anemic	40(38.8)	63(61.2)	1	1

Table 6. Factors associated with undernutrition at discharge among adult surgical patients in Hiwot Fana Specialized University Hospital and Jugal General Hospital, 2019 (N=363)

Variables		Nutritional status			
		Under nourished No. (%)	Normal No. (%)	COR 95%CI	AOR 95%CI
Hospitals	HFSUH	83(30.3)	191(69.7)	1.98(1.08,3.61)	2.56(0.71,9.18)
	Jugal	16(18.0)	73(82.0)	1	1
	18-40	66(25.3)	195(74.7)	0.24(0.11,0.52)	0.14(0.04,0.52)
Age	41-60	15(21.1)	56(78.9)	0.19(0.07,0.48)	0.15(0.04,0.52)
	>60	18(58.1)	13(41.9)	1	1
Sex	Male	59(24.8)	179(75.2)	0.70(0.43,1.12)	0.39(0.20,0.76)
	Female	40(32.0)	85(68.0)	1	1
Residence	Urban	19(13.4)	123(86.6)	0.27(0.15,0.47)	0.26(0.11,0.57)
	Rural	80(36.2)	141(63.8)	1	1
Educational status	Not able to read and write	46(30.1)	107(69.9)	1.57(.76,3.25)	0.49(0.16,1.46)
	Able to read and write and primary	41(26.6)	113(73.4)	1.33(0.64,2.76)	1.04(0.39,2.78)
	High school and above	12(21.4)	44(78.6)	1	1
Monthly income (n=364)	<1000	44(32.1)	93(67.9)	1.80(0.73,4.46)	2.17(0.59,7.92)
	1000-3000	36(22.5)	124(77.5)	1.12(0.45,2.78)	1.63(0.45,5.87)
	3001- 5000	7(20.6)	27(79.4)	1	1
Dietary diversity at discharge	Low	29(22.3)	101(77.7)	0.66(0.40,1.10)	0.90(0.38,2.15)
	High	70(30.0)	163(70.0)	1	1
Duration of disease	<2 weeks	68(25.5)	199(74.5)	0.71(0.43,1.19)	0.69(0.27,1.75)
	≥2weeks	31(32.3)	65(67.7)	1	1
History of surgery	Yes	7(33.3)	14(66.7)	1.35(0.53,3.47)	1.67(0.40,6.87)
	No	92(26.9)	250(73.1)	1	1
Type of current surgery	Elective	41(26.1)	116(73.9)	0.90(0.56,1.44)	0.34(0.14,0.82)
	Emergency	58(28.2)	148(71.8)	1	1
Co-morbidity	Yes	9(25.0)	27(75.0)	1	1
	No	90(27.5)	237(72.5)	1.13(0.51, 2.5)	0.67(0.18,2.43)
Complication after surgery	Yes	20(35.7)	36(64.3)	1	1
	No	79(25.7)	228(74.3)	0.624(0.34,1.14)	0.67(0.18,2.43)
Length of Hospital stay	<5 days	7(12.7)	48(87.3)	0.14(0.05, 0.42)	0.14(0.02,0.69)
	5-15 days	77(27.7)	201(72.3)	0.38(.179,0.82)	0.46(0.14,1.50)
	>15 days	15(50.0)	15(50.0)	1	1
Nutritional support during a hospital stay	Yes	48(30.0)	112(70.0)	1.27(0.80, 2.03)	0.92(0.49,1.71)
	No	51(25.1)	152(74.9)	1	1
Category of disease	Malignant	18(51.4)	17(48.6)	3.22(1.58, 6.55)	1.95(0.73,5.22)
	Nonmalignant	81(24.7)	247(75.3)	1	1

HFSUH; Hiwot Fana Specialized University Hospital

Discussion

The overall prevalence of undernutrition among adult admitted surgical patients was 21.9% and 24.9% at admission and discharge respectively. Being old age groups (>60 years) and rural residence were factors positively associated with undernourished at admission. Being female, in old age groups (>60 years), rural residence, having the emergency type of surgery, and hospital stay greater than 5 days were factors positively associated with being undernourished at discharge.

Undernutrition is a frequent concomitant of surgical illness. A study reported that up to 40% of patients were undernourished at the time of their admission and the majority of these patients continued to be nutritionally depleted throughout their hospital course (Beattie *et al*., 2000). In the current study, the magnitude of undernutrition before admission was 21.9%. This was similar to the study conducted in Brazil (22.2%) (Valente da Silva *et al*., 2012) and China (17.8%) (Fang *et al*., 2013). This was higher than another study conducted in Brazil (14.1%) (Leandro-Merhi *et al*., 2010). However, it was lower than similar study reports from Ethiopia (55.6%) (Haile *et al*., 2015) and pre-operative patients' reports from Albania (65.3%) (Shpata *et al*., 2014). The magnitude of undernutrition in the current study increased to 24.9% during discharge.

The possible reason for variation in the magnitude of undernutrition might be due to differences in socio-demographic/ economic status, sample size dietary habits, dietary diversity, types of cases (malignant vs non-malignant), the severity of illness (mild vs severely ill patients), types of surgery (elective vs emergency), the hospital set up, presence nutritional policy/support at the hospital, awareness of health professional about hospital malnutrition, nutritional assessment tool, and support.

In the current study, there is also significant mean weight depletion after the patients were admitted to the hospital. A similar report was found in a study from Geneva (Claude *et al*, 2004). A similar unintentional weight loss was reported in a study conducted in the Netherlands (Loh *et al*., 2012).

The possible reasons for the continued undernutrition and weight loss might be due diseases specific factors like loss of appetite, inflammation, swallowing difficulties, hyper catabolism; treatment-related factors, such as episodes of fasting, side effects of treatment; psychological factor (anxiety, depression, loneliness) or social factors (such as poverty) (Leistra, 2015) and their clinical condition like fistula, malabsorption syndrome, intestinal obstruction, and gastric atony (Senesse *et al*., 2008; Mariette *et al*., 2012). The above condition can reduce dietary intake, absorption of macro- and/or micronutrients, increased losses or altered requirements, and increased energy expenditure (in specific disease processes) (Mariette *et al*., 2012; Laky *et al*., 2010). In the current study majority of the patients were admitted for digestive tract surgery. A similar report indicates patients who undergo gastrointestinal surgery are at risk of nutritional depletion from inadequate nutritional intake and the stress of surgery both preoperatively and postoperatively (Mariette *et al*., 2012).

Undernutrition is associated with poor tolerance to treatment decreased quality of life, and increased healthcare costs (van Bokhorst *et al*., 2005). In the current study, there is a longer hospital stay in undernourished patients, and septicemia and wound infection are the commonest complications. Undernourished patients have delayed wound healing and longer lengths of hospital stay reported in India (Mahakalkar *et al*., 2013). All the complications developed in the current study seem from the drug-resistant infectious agent which might acquire from the hospital environment. Some studies had shown that infections are a classical complication of malnutrition and under feeding (Villet *et al*., 2005: Rubinson *et al*., 2004).

Routine evaluation of nutritional status was proposed which allows the identification of patients at risk of complications, particularly in the postoperative setting (Van Cutsem and Arends, 2005; Kondrup *et al*., 2003). These patients should be targeted for specific nutritional support (Weimann *et al*., 2006). Despite the high prevalence of undernutrition in the current study, nutritional therapy was seldom prescribed to patients. It was only 16.8% of those with elective surgery before two weeks of admission and 43.5% of those who did surgery obtained nutritional support/counseling from a

health professional. There are no official guidelines concerning hospital nutrition and the practice of nutritional therapy/support in the current study setting which can worsen the condition. In the current study setting, there is no weight and height scale which might simply use their physical judgment for nutritional assessment.

Different factors were identified to be associated with undernutrition. The magnitude of malnutrition was significantly higher in the age group >60 years. A similar significant report of undernutrition was reported among the old age/elderly in studies from Albania (Shpata *et al.,* 2014), Spain (Álvarez-Hernandez *et al*., 2012), Taiwan (Huang *et al*., 2014), a multi-centered study from several Latin American countries (Correia and Campos, 2003) and Brazil (Leandro-Merhi *et al.,* 2010; Villet *et al*., 2005). The elder patient might have a different condition that can impede or restrict nutritional intakes like loss of appetite, or co-morbidities with chronic diseases. Diabetes mellitus and hyperextension are some of the chronic conditions which requires nutritional restriction. Other reasons might be loneliness, depression, poor dentition and impairment of cognitive function, or secondary systemic disease (Shatenstein, 2008). The magnitude of undernutrition continues to increase from 47.1% to 52.1% among those with an age greatest than 60 after surgery in this study. There is a need for nutritional support for elderly patients.

In the current study, males were less likely to be undernourished. This is similar to a study conducted in Brazil (Barbosa *et al*., 2014). This may be attributed to a lack of social support, and women are more susceptible to malnutrition during menstruation, pregnancy, and childbirth (World Food Program, 2022).

Length of hospital stay was identified as associated with increased undernutrition in the current study. This was similar to studies conducted in Brazil (Leandro-Merhi *et al*., 2010; Barbosa *et al*., 2014), Australia (Laky *et al*., 2010), and multi-centered study from Latin America (Correia and Campos, 2003). The longer the patient remains in the hospital the greater the chance of poor nutritional status. This is most often related to the severity of the patient's disease, and increased metabolic demands. Prolonged hospital stay might also predispose a patient to skin colonization with more virulent hospital-based pathogens and also depression, or not like the food served at the hospital. The majority of the time, patients receive intravenous fluids or liquid diets for extended periods during receiving therapy, which can lead to weight loss (Correia *et al*., 2001).

Reducing the length of hospital stay (LOS) has the potential impact to decrease health care costs and risk of hospital acquired infections/diseases, and to improve patient's quality of life. Hospitals with reduced patient LOS are said to have done better than others with a longer stay (Laky et al., 2010; Ilesanmi and Fatiregun, 2014; Sang *et al*., 2013). Reductions in postoperative length of stay may produce cost savings that can be invested in other areas of surgical patient care (Gagarine *et al*., 2003).

This study used BMI for assessing undernutrition, but body weight can be inaccurate if edema, ascites, or fluid balance derangements are present, resulting in falsely high BMI measurements, which intern estimate undernutrition (Bruun *et al*, 1999). This study also used some basic nutritional assessment tools and biochemical assessment (hemoglobin). However, it did not include subjective assessment tools and other biochemical tests. This might provide additional information about the magnitude of the problems in the studied hospital

Conclusion

In the current study, undernutrition is a problem among surgical patients. Sex, age, and residence were common factors associated with undernutrition at admission. In addition, the type of current surgery and length of hospital stay were identified factors at the time of discharge. About one-fifth and less than half percentage of patients obtained nutritional support before admission and at discharge. Therefore, the hospital staff should apply nutritional assessment and nutritional counseling /support to surgically admitted patients considering the identified factors. The hospital in which the study was conducted and the regional health bureau should also reinforce nutritional assessment and nutritional counseling /support/therapy through guideline development, training, and monitoring of its application. The regional health bureau should also work on implementable strategies considering the identified factors. Further studies should be

conducted by using different nutritional assessment tools (subjective and objective), biochemical assessment, and unidentified factors on different type's patients in the country. In addition, there is a need for an assessment of the level of nutritional counseling and the factors associated with it among health professionals working in the hospital.

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Competing Interests

The authors declare that they have no competing interests.

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Authors' Contributions

ZT participated in proposal writing, data collection, analysis, interpretation, and critical review of the manuscript. FW participated in proposal writing, data collection, and critical review of the manuscript. HM participated in proposal writing, data collection, analysis, and critical review of the manuscript. All authors read and approved the final manuscript.

List of abbreviations

AOR; Adjusted Odds Ratio, CI: Confidence Interval, COR; Crude Odds Ratio, DDS; Dietary Diversity Score, EDHS; Ethiopian Demographic and Health Survey, MN; Micronutrients, PCA; Principal Component Analysis.

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