SCIENTIFIC
Research and Community

Review Article   Open Access

Prevalence, Risk Factors and Clinical Implications of Malnutrition among Cancer Patients: A Cross-Sectional Study

Bargude Balta

Comprehensive Specialized Hospital, College of Health Sciences, Hawassa University, Ethiopia

ABSTRACT

Background: Malnutrition in cancer patients arises from the local effects of a tumor, the host response to the tumor, and anticancer therapies. However, there is limited scientific evidence regarding the prevalence of malnutrition among cancer patients in Southern Ethiopia.

Objectives: The aim of the study was to assess the prevalence, risk factors, and clinical implications of malnutrition among cancer patients.

Methodology: A cross-sectional study was conducted among a randomly selected sample of 411 cancer patients visiting HUCSH. Data were collected by patient interview and chart review using a structured questionnaire adapted from a subjective global assessment tool. Data were analyzed by SPSS version 25.0. Descriptive statistics like frequency distribution, mean, median, and standard deviation were used to describe the characteristics and the magnitude of malnutrition among cancer patients. Bivariate and multivariate logistic regression were used to determine the association between predictor variables with the dependent variable.

Result: The overall magnitude of malnutrition among adult cancer patients receiving chemotherapy was 44.1% (95%; CI:38.8-49.1). No formal education AOR = 2.4 (95%CI:1.1-5.4), presence of diarrhea AR=1.8, (95% CI: 1.1-3), Pain during swallow AOR=3.5, (95% CI:1.4-9), decreased feeding habit last week AOR=5.6 (95%CI:3.0-10.4) were independent factors of cancer malnutrition.

Conclusion: Our finding revealed a higher incidence of malnutrition among adult cancer patients receiving chemotherapy. No formal education, presence of diarrhea, Pain during swallowing, and decreased feeding habits at last week were significantly associated with malnutrition among cancer patients. Efforts towards management of diarrhea, pain during the swallow, and improving feeding habits should be strengthened for cancer patients.

*Corresponding author

Bargude Balta, Comprehensive Specialized Hospital, College of Health Sciences, Hawassa University, Ethiopia.

Abbreviations
BMI: Body Mass Index
LMIC: Low Middle-Income Countries
NPC: Nasal Pharyngeal Cancer
NGO: Non-Governmental Organization
PG-SGA: Patient Generated-Subjective Global Assessment
SGA: Subjective Global Assessment

Background

Malnutrition affects one-third of the world's population in one form or another, and it severely affects two or three countries in eighteen percent of them [1]. Globally, GLOBOCAN 2020 estimates that there were 19.3 million new cases of cancer and roughly 10 million deaths from cancer worldwide in 2020. Cancer affects people differently depending on where they live, despite being one of the leading causes of death worldwide [2]. Cancer ranks second in the US in terms of cause of death and is a serious global public health issue [3].

Cancer patients have a 40–80% incidence and a 50%–80% magnitude of malnutrition, depending on the type of tumor, where it is located, the stage of the disease, the type of treatment they receive, and the nutritional assessment method used [4]. Cancer cachexia frequently manifests as malnutrition and muscle atrophy, which can impair a patient's ability to respond to treatment, chances of survival, and quality of life [5].

Acute or chronic malnutrition in cancer patients has been defined by a state of energy imbalance, inflammatory activity, and varying degrees of excess or deficiency in certain nutrients that alter body composition, function, and clinical outcome [6]. Furthermore, patients receive various treatments (chemotherapy, immunotherapy, radiotherapy, surgery, and other anticancer treatments) depending on the type of cancer they have. These treatments can have toxic side effects and, in some cases, permanently impair nutritional intake [7]. Malnutrition brought on by illness is a serious problem for public health in both developed and developing nations. In hospitalized adults, the reported magnitude varies between 20% and 50% [8].

In 2020, China contributed to 30% of cancer-related fatalities globally and 24% of newly reported cases [9]. Cancer is a systemic illness that directly affects the area where it first appears and can potentially spread to other locations. It can lead to several complications, including the loss of progressive organ function and dietary deprivation [10]. Malnutrition in patients with cancer can be caused by anticancer treatments, the host's reaction to the tumor, and the local effects caused by the tumor [11]. Cancer patients are especially vulnerable to malnutrition because their nutritional status is threatened by both the disease and its treatments [12]. Cancer patients in Africa often lack the funds to pay for their care, and general practitioners' incorrect diagnoses cause them to wait longer for a consultation. Most patients also have beliefs, fears, cultural factors, and ignorance, which can lead to serious complications like nutritional derangement [13].

Malnutrition due to a lack of protein and energy is a concern in developing countries such as Africa [14]. Cancer is quickly turning into a crisis for public health in middle-class and lower-class nations. Patients frequently arrive in sub-Saharan Africa with advanced illness. There is a dearth of personnel and a limited infrastructure for providing healthcare to patients. One of the biggest barriers to cancer treatment in sub-Saharan Africa is a lack of access to surgical care. The expense of cancer treatment, inadequate infrastructure, and a lack of medical oncologists, pathologists, radiation oncologists, and other healthcare professionals who are required for cancer treatment are further barriers [15].

This research will contribute to our understanding of the prevalence and risk factors of malnutrition in adult cancer patients. Additionally, it will support medical professionals in starting early investigations and management of malnutrition. Therefore, identifying malnutrition early on and providing nutritional support to hospitalized patients who are underweight will lower hospital mortality, morbidity, length of stay, improve healing, lower costs, lessen the burden on the patient, healthcare providers, and the hospital, and avoid complications. Simultaneously, this study is anticipated to close the gaps in the literature in the field of study and the nation where nutritional and cancer research is extremely uncommon.

Methodology
Study Setting
The capital of Southern Nations, Nationalities and Peoples Regional State (SNNPRS) and Sidama Regional State is Hawassa City. There are 32 kebeles and 8 subcities within the city. In Hawassa City, there are ten health centres and three governmental hospitals. The Hawassa City Administration Health Department's 2013 EFY population profile states that the city has 394,057 residents overall. The Hawassa University Comprehensive Specialised Hospital, Cancer Treatment Centre (HUCSH) is the sole hospital providing extensive care to over 25 million people in southern Ethiopia. HUCSH-CTC is situated in Hawassa, the Sidama Regional State's capital. The HUCSH Oncology Unit is a premier cancer treatment facility that offers palliative care, chemotherapy, and other comprehensive medical services.

Study Design
Institution based cross-sectional study was conducted to assess prevalence, risk factors and clinical implications of malnutrition among cancer patients.

Source Population
The source population for this study were adults diagnosed with cancer and treated with chemotherapy at Hawassa Comprehensive Specialized Hospital.

Study Population
All adults diagnosed with cancer and treated with chemotherapy at Hawassa Comprehensive Specialized Hospital talking chemotherapy treatment above 3 cycle.

Eligibility Criteria
Inclusion Criteria
➢ Competent subject who can give written or oral informed consent
➢ All adult out patients taking chemotherapy treatment above 3 cycle

Exclusion Criteria
➢ Below 3 cycle treatment of chemotherapy
➢ Ongoing radiation treatment
➢ New cancer diagnosed

Sample Size Determination and Sampling Procedure
Sample size for 1st objective of study was computed based on a single proportion population formula by using prevalence of malnutrition in cancer patients in previous similar study in Ethiopia black lion hospital is 58.2% and taking the margin of error 5% [16].

Where desired sample size after adding 10% non-response rate was 411. The reason Hawassa Comprehensive Specialty Hospital (HCSH) was chosen for this research is that it is the only public hospital that treats cancer patients from all over the nation. Every day, the charts of HCSH patients who meet the requirements are identified from the oncology unit. Throughout the study period, all patients were included up until the necessary sample size was reached.

Definition of Terms
Adult Oncology Patients
Patients above 18 years of age receiving chemotherapy treatment for cancer disease in the oncology wards.

SGA Score of Nutritional Status
According to the sum of points assigned to each item, patients were initially classified in: Well-nourished: < 17 points. Malnourished (moderate and severe): > 17 points [17].

Data Collection Procedures
A globally assessed tool that has been pretested was used to gather data. The instrument was taken from comparable Indian studies [17]. and was written in English, translated into Amharic, and then back into English to ensure that the meanings were consistent.A one-day training programme is scheduled for two nurses employed at the oncology centre. The training primarily covered the purpose of the study, each section of the questionnaires, consents, the right to withdraw at any time, the right to participate or not, confidentiality, and how to proceed. Information was gathered in June and July of 2022.

Data were gathered from two different sources. The responses of sampled respondents who qualified for interviews and their medical records served as the main sources of data. Modifications to the SGA tool were adopted from India for the purpose of screening

cancer patients for malnutrition. Prior to the actual data collection, the questionnaire was pre-tested in 5% of the sample size at other sites, and adjustments were made to the instruments as necessary. Every day, the principal investigator and the supervisors verified that the data were complete. The principal investigator oversaw the entire process of gathering data. Two or more of the following traits, whether localised or widespread, indicate malnutrition: inadequate energy intake, weight loss, loss of muscle mass, and loss of subcutaneous fat [17].

Data Analysis

At the conclusion of each data collection day, the collected data were examined to ensure it was accurate. Epi data version 3.1 software was used to code, enter, and clean the collected data. After that, it was exported to SPSS 25.0 for examination. Frequency distribution and variable percentages were calculated throughout the analysis process to characterize and enumerate the fundamental sociodemographic traits of the respondents.

The association between predictor variables and the dependent variable (malnutrition) was ascertained through the use of a logistic regression model in bivariate and multivariable analysis. Using a binary logistic regression analysis, the first bivariate relationship between each independent variable and outcome variable was examined. Multivariate logistic regression was performed using the variables that exhibited a significant association with a p-value of less than 0.25 in bivariate analysis. Logistic regression with multiple variables

Data Quality Assurance

The following actions were taken to guarantee the data's quality. Prior to the actual data collection, the questionnaire was pre-tested on 5% of the cancer center's sample size, and adjustments were made to the instruments as necessary. All supervisors and data collectors received intensive training lasting one day. Daily checks were made by the principal investigator and supervisors to ensure consistency, clarity, and completeness of the data. Ultimately, the supervisors cross-checked the completed questionnaires to ensure they were complete before the data collectors gathered the completed forms. The principal investigator kept an eye on the entire data collection procedure.

Results

Sociodemographic Characteristics of Adult Cancer Patients

The study included 399 patients in total, with a 97.1% response rate. 221 (59.9%) of the 399 respondents were women. The participants' average age was 45.2 ± 13.9. 369 patients, or 92.5%, were younger than 65 years old out of the total. 174 people, or 43.6%, identified as Orthodox Christians. Of the participants, 106 (26.6%) went to primary school, and 84 (21.1%) had no formal education. In terms of ethnicity, 239 (57.4%) of the participants were urban dwellers, and 91 (32.4%) were Oromo. 270 respondents, or 67.7%, were married. Approximately 365 (91.5%) have never smoked, and 367 (92.0%) have never consumed alcohol (table 1)

Table 1: Sociodemographic Characteristics among Adult Cancer Patients Receiving Chemotherapy Treatment (n=399)

Characteristics	Category	No (%)
Age	<65	369(92.5%)
	≥65	30(7.5%)
Sex	Male	178(44.6%)
	Female	221(59.9%)
Residence	Urban	239(57.4%)
	Rural	160(40.1%)
Region	Oromo	91(32.4%)
	Sidama	71(25.3%)
	SNNPR	39(13.9%)
	Others	23(8.2%)
Religion	Orthodox	174(43.6%)
	Muslim	94(23.6%)
	Protestant	118(29.6%)
	Catholic	11(2.8%)
	Others	2(0.5%)
Marital status	Married	270(67.7%)
	Single	80(20.1%)
	Divorced	29(7.3%)
	Widowed	20(5.0%)
Occupation	Farmer	116(29.1%)
	Merchant	95(23.8%)
	Government employee	82(20.6%)
	Self-employee	76(19.0%)
	Student	20(5.0%)
	Other	10(2.5%)
Income	≤ 1000 birr	89(22.3%)
	1000-3000 birr	103(25.8%)
	> 3000 birr	207(51.9%)
Education	No education	84(21.1%)
	Primary education	106(26.6%)
	Secondary education	111(27.8%)
	higher education	98(24.6%)
Drinking Alcohol now	Yes	68 (17.0%)
	No	331 (83.0%)
Experience Smoking habits	Yes	34 (8.5%)
	No	365 (91.5%)
Experience Chewing chat	Yes	32 (8.0%)
	No	367 (92.0%)

Disease and Treatment Related Factors among Adult Cancer Patients

Of the 399 respondents, 61(15.3 %) had pre-existing co morbidities and 58 (12.5%) had a family history of cancer. With regard to the type of cancer 120(30.1%) had breast cancer, 72(18.0%) rectal cancer. The large proportion of respondents diagnosed with cancer at stage III 183(45.9%) stage (Table 2)

Table 2: Disease and Treatment Related Factors among Adult Cancer Patients Receiving Chemotherapy Treatment (n=399)

Characteristics	Category	No (%)
Family history of cancer	Yes	58(12.5%)
	No	349(87.5%)
co morbidity	Yes	61(15.3%)
	No	338(84.7%)
Types of cancer	Breast cancer	120(30.1%)
	Colorectal	72(18.0%)
	Lung	47(11.8%)
	Gastric	32(8.0%)
	Nasopharyngeal	31(7.8%)
	Others	97(24.3%)
Stages of cancer	Stage one	5(1.3%)
	Stage two	80(20.1%)
	Stage three	183(45.9%)
	Stage four	131(32.8%)
Cycle	Third	111(27.8 %)
	Fourth	131(32.8%)
	Fifth	59(14.8%)
	Sixth and above	68(24.4%)

Feeding Habit and Nutritional Status among Adult Cancer Patients A majority of the 262 participants, or 65.7%, consumed solid food. 52.4% of the 209 respondents, or nearly half, reported eating regularly. 235 patients, or 58.9% of the total, consumed food on their own. 61(21.6%) out of 353(88.5%) respondents reported not experiencing any pain while eating. Table 4 shows that 294 (73.7%) felt sick, 263 (64.9%) vomited, 138 (34.6%) had diarrhea, and one-fourth of 88 (22.1%) experienced loss of appetite. According to the respondents' nutritional status, 219 people, or more than half, were underweight (54.9%). Malnutrition affects 176 people (44.1%) (Table 3).

Table 3: Feeding Habit and Nutritional Status among Adult Cancer Patients Receiving Chemotherapy Treatment (n=399)

Vomiting	Yes	263(65.9%)
	No	136(34.1%)
Diarrhea	Yes	138(34.6%)
	No	261(65.4%)
Constipation	Yes	182(45.6%)
	No	217(54.4%)
How much do you eat within 24Hours	Regular	209(52.4%)
	Irregular	145(36.3%)
	I do not know	45(11.3%)
Weight loss in the past 3 months?	Yes	269(67.4%)
	No	130(32.6%)
feeding habit in the last week	Decreased	249(62.4%)
	Not decreased	150(37.6%)
Regular eating of breakfast habit	Regular	277(69.4%)
	Not regular	122(30.6%)

How many times do you eat per day	once	7(1.8%)
	twice	122(30.6%)
	three times	237(59.4%)
	four times	33(8.3%)
How much fluid do you take per day	less than 3 litters	152(38.1%)
	3-5 litters	182(45.6%)
	more than 5 litters	65(16.3%)
How did you eat	I cannot eat without support	67(16.3%)
	partially support by others	97(24.3%)
	I can eat without any support	235(58.9%)
Can you walk?	Yes	367(92%)
	No	32 (8%)

Magnitude of Malnutrition in Relation to Type of Cancer
Overall, 26.1% of breast cancer, 19.3% of colorectal cancer, 13.1% of lung cancer, 12.5 % of nasopharyngeal cancer, 8% of gastric ca and 21% of others cancer have malnutrition seen in study population (Figure 1).
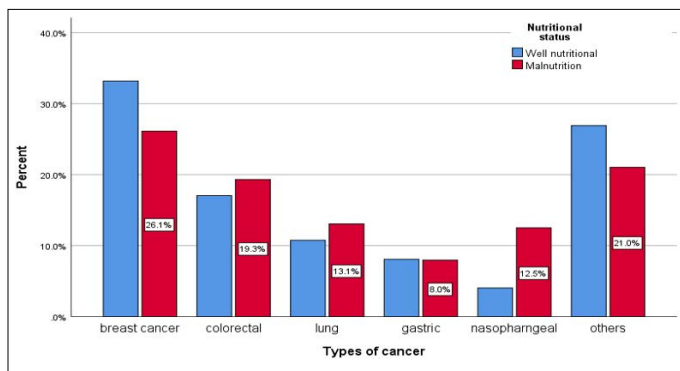

Figure 1: Shows that Magnitude of Malnutrition Based on Cancer Types (n=399)

Bivariate and Multivariate Analysis of Factors Associated with Malnutrition
The factors linked to cancer malnutrition were analyzed using both bivariate and multivariate logistic regression analyses. Bivariable analysis revealed that the following factors were significantly linked to cancer malnutrition: education level, diarrhea, vomiting, nausea, residence, loss of appetite, pain during swallowing, decreased feeding habit last week, and alcohol consumption. Variables like Education Level: No formal education AOR = 2.4: (1.1-5.4), Diarrhea AR = 1.8, 95% CI: =1.1-3, Pain during swallow AOR = 3.5, 95% CI=1.4-9, decreased feeding habit last week AOR = 5.6, 95% CI=3-10.4) were significantly associated with malnutrition on cancer patients receiving chemotherapy after the effect of potentially confounding variables was controlled for using a multivariable logistic regression model (Table 4).

Table 4: Bivariate and Multivariate Analysis of Factors Associated with Malnutrition among Cancer Patients (n=399)

Variable	Nutritional status		COR (95%CI)	P _value	AOR (95%CI)	P-value
	Yes	N0				
Education						
No formal education	42	42	3.3(1.7-6)	0.000	2.4 (1.1,5.4)	0.03
Primary	61	45	4.4(2.4-8.1)	0.000	3.4 (0.9,5)	0.01
Secondary	50	61	2.6(1.5-4.9)	0.001	2(0.99-3.9)	0.055
Above secondary	23	75	Ref		Ref	
Diarrhea						
Yes	79	59	2.3(1.4-3.4)	0.000	1.8(1.1-3.0)	0.024
No	97	164	Ref		Ref	
Vomiting						
Yes	149	114	5.3(3.2—8)	0.000	1.5(0.7,3.1)	0.2
No	27	109	Ref		Ref	
Nausea						
Yes	158	136	5.6(3.2-9.8)	0.000	1.4(0.7-2.9)	0.37
No	18	87	Ref		Ref	
Residence						
Urban	90	149	Ref		Ref	
Rural	86	74	0.5(0.3-0.8)	0.002	0.7(0.4,1.2)	0.25
Loss of appetite						
Yes	62	26	4.1(2.5-6.9)	0.000	1.5(0.8-2.9)	0.2
No	114	197	Ref		Ref	
Pain during swallow						
Yes	37	139	6.3(2.9-13.5)	0.000	3.5(1.4-9.0)	0.008
No	9	214	Ref		Ref	
Decreased feeding habit last week						
Yes	154	95	9.4(5.6,15.8)	0.000	5.6(3-10.4)	0.000
No	22	128	Ref		Ref	
Alcohol consumption						
Yes	21	47	0.5(0.3-0.9)	0.02	0.6(0.3-1)	0.09
N0	155	176	Ref		Ref	

Discussion

There is a dearth of information in Ethiopia and other African nations about malnutrition among cancer patients. The primary objective of the research was to evaluate the extent of malnutrition related to cancer and the associated risk factors in adult cancer patients undergoing chemotherapy at Hawassa Comprehensive Specialized Hospital in Ethiopia. Adult cancer patients receiving chemotherapy had an overall malnutrition rate of 44.1%. Independent predictors of cancer malnutrition included education level, the presence of diarrhea, pain when swallowing, and a reduction in feeding frequency within the previous week.

The observed rate of malnutrition in cancer patients is lower than that of a Korean study that discovered 61%, Australia shows 66%, USA shows that 51%, and France 52% [18-20]. Moderate and severe malnutrition affected 27% and 25% of cases, respectively [21]. Malaysian study 56.9%, Tehran 54% and Ethiopia 58.2% this discrepancy might be due to socio demographic characteristics difference, study population, difference in expanded health service provision. In contradictory, to this our finding were higher than India shows that 39.6%, Malaysia 26.5%, Brazil shows that 39.3%, France 39% of cancer patients were malnourished [22-28]. The discrepancy in malnutrition was may be due to no comprehensive nutritional program for cancer patients in study setting or it may be due to socio demographic differences.

Our results show that patients with diarrhea are 1.8 times more likely to experience malnutrition, which is consistent with findings from an earlier Ethiopian study [29]. The two main indicators of cancer-related malnutrition were difficulty swallowing and reduced feeding; individuals with difficulty swallowing were 3.5 times more likely to be malnourished, which is consistent with findings from a previous Canadian study [30]. In this study, pain during swallowing was one of the individual symptoms that was significantly correlated with overall malnutrition, which is consistent with earlier Australian research [31].

The high level of malnutrition found in the study was a typical sign that the area under investigation lacked a comprehensive cancer nutrition Programme. For cancer patients, malnutrition added to their burden. Effectively managing the side effects of chemotherapy, such as pain and diarrhea, as well as raising

awareness about cancer treatment, are crucial in mitigating the current issue. Among the limitations of the study is its cross-sectional design, which makes it impossible to establish causal correlations among adult cancer patients undergoing chemotherapy.

Conclusion

Compared to previous findings, the current study found a higher incidence of malnutrition among adult cancer patients receiving chemotherapy. Cancer patients' lack of formal education, the existence of diarrhea, swallowing pain, and a reduction in feeding habits within the past week were all strongly linked to malnutrition. For cancer patients, efforts to treat diarrhea, ease swallowing discomfort, and enhance feeding habits should be stepped up. Hospitals ought to begin providing patients undergoing chemotherapy with specialized nutritional programs in light of the seriousness of malnutrition among cancer patients [32-41].

Ethical and Consent to Participate

The study had approvals by Department of public health Ethics Committee, CHS, pharma college (Reference: PH/C/018). Official letter was written to Hawassa university comprehensive specialized hospital. Written consent/assent was taken from the study participants and their parents or guardian after telling the objective of the study before signature. Participants were also informed that their participation is based on their willingness and they can discontinue their participation at any time they want. Participants information was anonymous and kept confidential.

Consent for Publication

Not applicable

Availability of Data and Materials

The datasets analyzed during the current study are available from the corresponding author upon reasonable request.

Competing Interests

We have read the journal's policy and the authors of this manuscript have no competing interests exist.

Authors' Contributions

AZ and BB Conceptualized the study: All were involved in the data curation, methodology, project administration and analysis. AZ were involved in the visualization; BB and AZ took part in the Writing of the original draft AZ and BB reviewed & edited and all were involved in the manuscript preparation.

References

1. Zapata ME, Soruco AI, Carmuega E (2020) Malnutrition in all its forms and socio-economic indicators in Argentina. Public health nutrition 23: s13-s20.
2. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, et al. (2021) Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. American cancer society journal 71: 209-249.
3. Siegel RL, Miller KD, Fuchs HE, Jemal Ahmedin (2021) Cancer statistics. CA Cancer J Clin 71: 7-33.
4. Lis CG, Gupta D, Lammersfeld CA, Markman M, Vashi PG (2012) Role of Nutritional Status in Predicting Quality of Life Outcomes in Cancer–A Systematic Review of The Epidemiological Literature. Nutrition Journal 11: 27.
5. Castillo-Martínez L, Castro-Eguiluz D, Copca-Mendoza ET, Pérez-Camargo DA, Reyes-Torres CA, et al. (2018) Nutritional Assessment Tools for the Identification of Malnutrition and Nutritional Risk Associated with Cancer Treatment. Revista de investigacion clinica; organo del Hospital de Enfermedades de la Nutricion 70: 121-125.
6. Sauer AAAV (2012) Improving Outcomes with Nutrition in Patients with Cancer. Oncology Nursing Society 5.
7. Cotogni P, Stragliotto S, Ossola M, Collo A, Riso S (2021) On Behalf of The Intersociety Italian Working Group for Nutritional Support in C. The Role of Nutritional Support for Cancer Patients in Palliative Care. Nutrients 13.
8. Correia M, Perman MI, Waitzberg DL (2017) Hospital malnutrition in Latin America: A systematic review. Clinical nutrition (Edinburgh, Scotland) 36: 958-967.
9. Cao W, Chen H-D, Yu Y-W, Li N, Chen W-Q (2021) Changing profiles of cancer burden worldwide and in China: a secondary analysis of the global cancer statistics 2020. Chinese medical journal 134: 783.
10. Marian AE van Bokhorst-de van der Schueren (2005) Nutritional support strategies for malnourished cancer patients. European Journal of Oncology 9: S74-S83.
11. Maarten von Meyenfeldt (2005) Cancer-associated malnutrition: an introduction. European journal of oncology nursing 9: S35-S38.
12. Arends J, Baracos V, Bertz H, Bozzetti F, Calder P, et al. (2017) ESPEN expert group recommendations for action against cancer-related malnutrition. clinical nutrition 36: 1187-1196.
13. Ekortarl A, Ndom P, Sacks A (2007) A study of patients who appear with far advanced cancer at Yaounde General Hospital, Cameroon, Africa. Wiley Online Library 16: 2557.
14. Temba MC, Njobeh PB, Adebo OA, Olugbile AO, Kayitesi E (2016) The role of compositing cereals with legumes to alleviate protein energy malnutrition in Africa. Journal of food science and technology 51: 543-554.
15. Kingham TP, Alatise OI, Vanderpuye V, Abdulkareem FB (2013) Treatment of cancer in sub-Saharan Africa. Lancet oncology 14: e158-e167.
16. Gebremedhin TK, Cherie A, Tolera BD, Atinafu BT, Demelew TM (2021) Prevalence and risk factors of malnutrition among adult cancer patients receiving chemotherapy treatment in cancer center, Ethiopia: cross-sectional study. Heliyon 7: e07362.
17. M Shirodkar KMM (2016) Subjective global assessment: a simple and reliablescreening tool for malnutrition among Indians. Indian Society of Gastroenterology 24: 246-250.
18. Wie GA, Cho YA, Kim SY, Kim SM, Bae JM, et al. (2010) Magnitude and risk factors of malnutrition among cancer patients according to tumor location and stage in the National Cancer Center in Korea. Nutrition 26: 263-268.
19. Jane A READ SBC, Philip BEALE, Stephen J CLARKE (2006) An evaluation of the Magnitude of malnutrition in cancer patients attending the outpatient oncology clinic Sydney Cancer Center, Royal Prince Alfred Hospital and

Concord Repatriation General Hospital, Sydney, Australia. Asia-Pacific Journal of Clinical Oncology 2: 80-86.

20. Muscaritoli M, Lucia S, Farcomeni A, Lorusso V, Saracino V, et al. (2017) Magnitude of malnutrition in patients at first medical oncology visit: the PreMiO study. Oncotarget 8: 79884.

21. Attar A, Malka D, Sabaté J, Bonnetain F, Lecomte T, et al. (2012) Malnutrition is high and underestimated during chemotherapy in gastrointestinal cancer: an AGEO prospective cross-sectional multicenter study. Nutrition and cancer 64: 535-542.

22. Stefan D (2015) Cancer care in Africa: an overview of resources. Journal of Global oncology 1: 306.

23. Segura A, Pardo J, Jara C, Zugazabeitia L, Carulla J, et al. (2005) An epidemiological evaluation of the Magnitude of malnutrition in Spanish patients with locally advanced or metastatic cancer. Clinical Nutrition 24: 801-814.

24. Gebremedhin TK, Cherie A, Dugassa B, Atinafu BT, Demlew TMJH (2021) Magnitude and risk factors of malnutrition among adult cancer patients receiving chemotherapy treatment in cancer center, Ethiopia: Cross-sectional study. Heliyon 7: e07362.

25. De Melo Silva FR, de Oliveira MGOA, Souza ASR, Figueroa JN (2015) Factors associated with malnutrition in hospitalized cancer patients: a croos-sectional study. Indian Journal of critical care medicine 14: 1-8.

26. Norshariza J, Siti Farrah Zaidah MY, Aini Zaharah AJ, Betti Sharina MHL, Neoh MK, et al. (2017) Prevalence of Malnutrition among Hospitalised Adult Cancer Patients at the National Cancer Institute, Putrajaya, Malaysia. Malaysian Journal of Nutrition 23.

27. D Almeida CA, Peres W, De Pinho N, Martucci R, Rodrigues V, et al. (2020) Magnitude of malnutrition in older hospitalized Cancer patients: a multicenter and multiregional study. Nutrition health & aging 24: 166-171.

28. Hébuterne X, Lemarié E, Michallet M, de Montreuil CB, Schneider SM, et al. (2014) Magnitude of malnutrition and current use of nutrition support in patients with cancer. Parenteral and Enteral Nutrition 38: 196-204.

29. Gebremedhin TK, Cherie A, Tolera BD, Atinafu BT, Demelew TM (2021) Magnitude and risk factors of malnutrition among adult cancer patients receiving chemotherapy treatment in cancer center, Ethiopia: cross-sectional study. Heliyon 7: e07362.

30. Farhangfar A, Makarewicz M, Ghosh S, Jha N, Scrimger R, et al. (2014) Nutrition impact symptoms in a population cohort of head and neck cancer patients: Multivariate regression analysis of symptoms on oral intake, weight loss and survival. Oral Oncol 50: 877-883.

31. Brown T, Banks M, Hughes BGM, Lin C, Kenny L, et al. (2017) Tube feeding during treatment for head and neck cancer-Adherence and patient reported barriers. Oral Oncol 72: 140-149.

32. Okobia MN (2003) Cancer care in Sub-Saharan Africa–urgent need for population-based cancer registries. Ethiopia journal of health development 17: 89-98.

33. Morhason-Bello IO, Odedina F, Rebbeck TR, Harford J, Dangou J-M, et al. (2013) Challenges and opportunities in cancer control in Africa: a perspective from the African Organisation for Research and Training in Cancer. Lancet oncology 14: e142-e151.

34. Memirie ST, Habtemariam MK, Asefa M, Deressa BT, Abayneh G, et al. (2018) Estimates of cancer incidence in Ethiopia in 2015 using population-based registry data. Global oncology 4: 1-11.

35. Tigeneh W, Molla A, Abreha A, Assefa MJIJCRMM (2015) Pattern of cancer in Tikur Anbessa specialized hospital oncology center in Ethiopia from 1998 to 2010. International Journal of Cancer Research and Molecular Mechanisms 1.

36. Da Silva TL, Borges Pretto AD, Gonzalez MC, Pastore CA (2015) Association Between Nutritional Subjective Global Assessment and Manual Dynamometry in Cancer Patients of a Chemotherapy Service in Southern Brazil. Revista Brasileira De Oncologia Clínica 11: 40.

37. Perez-Escamilla R, Bermudez O, Buccini GS, Kumanyika S, Lutter CK, et al. (2018) Nutrition disparities and the global burden of malnutrition. BMJ (Clinical research ed) 361: k2252.

38. Muscaritoli M, Lucia S, Farcomeni A, Lorusso, Saracino V, et al. (2017) Prevalence of malnutrition in patients at first medical oncology visit: the PreMiO study. Visit Oncotarget 8: 79884-79896.

39. Nho JH, Kim SR, Kwon YS (2014) Depression and Appetite: Predictors of Malnutrition in Gynecologic Cancer. Supportive Care in Cancer 22: 3081-3088.

40. Kumar NB (2012) Malnutrition and Nutritional Therapy Approaches in Cancer Patients, In Nutritional Management of Cancer Treatment Effects. Springer https://link.springer.com/book/10.1007/978-3-642-27233-2.

41. D Almeida CA, Peres W, De Pinho N, Martucci R, Rodrigues V, et al. (2020) Prevalence of malnutrition in older hospitalized Cancer patients: a multicenter and multiregional study. J Nutr Health Aging 24: 166-171.