Journal of Taibah University Medical Sciences (2022) 17(2), 264–270

Taibah University

Journal of Taibah University Medical Sciences

www.sciencedirect.com

Original Article

Nutrition and functional status among Palestinian cancer patients receiving chemotherapy

May H. Hamdan, PhD in Human Nutrition [a],
Manal M. Badrasawi, PhD in Clinical Nutrition [b,*] and
Reem W. Abu Alwafa, Master in Nutrition and Food Technology [b]

[a] *Healthy and Therapeutic Nutrition Department, College of Medicine and Health Sciences, Palestine Polytechnic University, Hebron, Palestine*
[b] *Nutrition and Food Technology Department, Faculty of Agriculture and Veterinary Medicine, An-Najah National University, Nablus, Palestine*

Received 2 June 2021; revised 21 November 2021; accepted 26 November 2021; Available online 28 December 2021

الملخص

أهداف البحث: تهدف هذه الدراسة الى تحديد مدى انتشارسوء التغذية لدى مرضى السرطان وكذلك لتقييم الحالة التغذوية والوظيفية لمرضى السرطان الذين يخضعون للعلاج الكيميائي في مستشفى بيت جالا الحكومي في وحدة الأورام في فلسطين.

طرق البحث: شملت هذه الدراسة المقطعيّة المستعرضة مجموعة من مرضى السرطان الذين يتلقّون العلاج الكيميائي. تم تحديد الوضع التغذوي باستخدام قياسات الجسم و البيانات البيوكيميائية من ملفات المرضى. تقدير احتمال خطر سوء التغذية تم باستخدام فحص مخاطر التغذية2002.تقييم الحالة الوظيفية تم باستخدام التقييم الوظيفي لعلاج فقدان الشهية/الأعتلال .. تم استخدام نظام استدعاء النظام الغذائي لمدة ثلاثة أيام لتحديد المدخول الغذائي

النتائج: شتمل التحليل النهائي للدراسة على ١٥٣مريضاً. أظهرت النتائج أنّ ٢٣.٨٪ من المرضى لديهم خطر سوء التغذية. أولئك الذين لم يتعرضوا لخطر سوء التغذية كان لديهم تحسن طفيف في الوضع الوظيفي. كان سوء التغذية أكثر انتشارًا لدى المرضى عمر ٦٥ فما فوق، و الذكور، والمدخنين السابقين والحاليين ، ومن يعانون من أربع عوارض صحية أو أكثر. عمر المريض(٦٠ <) كان المؤشر الوحيدلسوء التغذية في النموذج اللوجستي.

الاستنتاجات: عينة الدراسة احتوت على نسبة انتشار لسوء التغذية يمكن الاعتداد بها. المرضى الذين لم يظهر لديهم خطر سوء التغذية كانوا بحالة وظيفية أفضل بشكل طفيف من أولئك الذين ظهر لديهم خطر سوء التغذية.

الكلمات المفتاحية: سرطان؛ العلاج الكيميائي؛ الحالة الوظيفية؛ سوء التغذية؛ الحالة التغذوية

Abstract

Objectives: This study aims to determine the prevalence of malnutrition among cancer patients and to assess the nutritional and functional status of cancer patients undergoing chemotherapy at the Oncology unit of Beit Jala Governmental Hospital in Palestine.

Methods: During the data collection period, all patients who received chemotherapy at the hospital's chemotherapy unit were included in this cross-sectional analysis. Anthropometric measurements and biochemical data from the patients' files were used to determine nutritional status. The Nutrition Risk Screening (NRS) 2002 was used to assess the risk of malnutrition. The Functional Assessment of Anorexia/Cachexia Therapy (FAACT) was used to determine functional status. A three-day diet recall was used to determine dietary intake.

Results: A total of 153 patients were included in the final analysis. The results revealed that 23.8% of the patients were at risk of malnutrition. Those who were not at risk of malnutrition had a marginally improved functional position. Furthermore, patients aged ≥65 years, males, smokers or former smokers, and those with four or more

* Corresponding address: Nutrition and Food Technology Department, Faculty of Agriculture and Veterinary Medicine, An-Najah National University, P. O. Box: 7, Nablus, Palestine.
E-mail: m.badrasawi@najah.edu (M.M. Badrasawi)

Peer review under responsibility of Taibah University.

ELSEVIER Production and hosting by Elsevier

 https://doi.org/10.1016/j.jtumed.2021.11.006

comorbidities had a significantly higher prevalence of malnutrition. In the logistic model, age >60 years was the only indicator of malnutrition.

Conclusion: Malnutrition has a considerable prevalence in the study sample. However, the functional status of patients who were not at risk of malnutrition was marginally better than that of those with malnutrition risk.

Keywords: Cancer; Chemotherapy; Functional status; Malnutrition; Nutrition status

Introduction

Malnutrition is defined as a sub-acute or chronic nutritional condition marked by changes in body composition and function as a result of under- or over-nutrition, as well as inflammation.[1] Malnutrition is primarily caused by reduced dietary intake, absorption deficiency, requirement alteration, and increased energy expenditure.[2] Given the correlation between malnutrition and cancer, malnutrition affects 20%−80% of patients with cancer.[3] Unexplained weight loss is a common symptom of cancer progression and is conventional evidence of malnutrition. Furthermore, malnutrition may impact the clinical decision to remove the tumour and increase the risk of postoperative complications.[4] It prolongs hospitalisation and increases care expenditures.[5]

Cancer is a leading cause of death worldwide.[6] In 2016, there were 2536 cancer cases in the West Bank, up 5.7% from 2015 with incidence rate of 86.4/100,000 in 2016,[7] whereas Gaza's rate was 89/100,000 in the same year.[8] After heart disease (30%), cancer is the second leading cause of death in Palestine (14%). Cancer symptoms or side effects of treatment can cause malnutrition.[9] For example, some of the side effects of chemotherapy include nausea, vomiting, mucositis, and taste changes.[10] They are associated with a decrease in food intake, changes in energy expenditure, and loss of lean body mass.[11] Chemotherapy is administered without nutritional monitoring in Palestine, and ergo malnutrition is a serious problem among cancer patients. The risk of malnutrition among Palestinian cancer patients receiving chemotherapy is investigated in this study. Thus study further probes the relationship between patient characteristics, lifestyle, and the functional status and risk of malnutrition.

Materials and Methods

Study design

This cross-sectional study was conducted at the Beit Jala Governmental Hospital's Oncology Department between December 2020 and February 2021. Patients receiving cancer therapy above the age of 18 years were eligible, and those with speech, hearing, or mental health difficulties were excluded. The Chochrane formula for prevalence studies was used to calculate the sample size.[12] The required sample size was 130 participants, but with dropouts, the sample size increased to 150. A total of 212 cancer patients were invited to participate in the study; only 162 out of the 212 invited participants agreed to participate. The final participant count was 132 (76.4% response rate). The Research Committee at Palestinian Polytechnic University has provided the ethical approval for the study protocol (Ref. no. KA/41/2019, Date: 16-11-2019). In addition, the permission to perform the study was obtained from the Palestinian Ministry of Health. Further, patients signed a written consent form prior to data collection.

Research tools and data collection

Patients were asked to complete a pre-designed questionnaire by the members of the research team. The questionnaire aimed to determine socio-demographics, medical history, cancer-related details, lifestyle, nutritional status, functional status, and dietary intake. Cancer-related data include the date of diagnosis, location, stage, treatment, completed and current chemotherapy cycles, and chemotherapy side effects. The lifestyle survey included questions about smoking (type, length, and amount) and exercise (walking and going to the gym before and after chemotherapy).

Nutritional assessment

Anthropometric measurements (weight and height), biochemical data for albumin, haemoglobin, blood urea nitrogen (BUN), and creatinine were extracted from patients' files, while a 24-h dietary recall (24HR) was used to determine nutritional status.[13] A nutritional risk assessment (NRS 2002) tool was used to evaluate the risk of malnutrition by assessing body mass index (BMI), recent weight loss percentage, and food intake changes. A score of 3 or more on the NRS 2002 indicates malnutrition risk and necessitates nutritional intervention.[9] In this study, we measured current BMI, weight loss in the past 3 months, and dietary intake by the 3 days 24HR. The research team conducted interviews with patients via phone calls for three consecutive days while chemotherapy sessions were in progress.[14] The patients' dietary intake was measured using ESHA 10.8 software, ESHA Research company, 4747 Skyline Rd S, Ste 100 Salem, OR, US 97306.

Functional assessment

The Functional Assessment of Anorexia/Cachexia Therapy (FAACT) Questionnaire was used to determine functional status. FAACT is a patient-reported outcome (PRO) method for assessing anorexia and cachexia-related symptoms and concerns. It includes a 12-item anorexia/cachexia scale (A/CS) and a 27-item Functional Assessment Cancer Therapy-General (FACT-G) tool to determine health-related quality of life (HRQL). The cumulative FAACT score is calculated by adding the A/CS and FACT-G ratings.[15]

Data analysis

This study adopted the Statistical Package for Social Sciences (SPSS) program version 23.0 (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.), for all statistical analyses. For all statistical measures used in the analysis, an alpha level of 0.05 was used. Univariate regression using the chi-square test for categorical variables and a mean difference using an independent t-test for continuous variables were used to assess the malnutrition risk predictors, considering NRS score as the dependent variable. To assess the predictors of malnutrition risk factors using binary logistic regression, a multivariate model was used. The tested predictors were socio-demographics, medical history, lifestyle, nutritional status, and functional status. Variables that showed significant association with malnutrition in the univariate analysis were included in the model as predictors. Outliers, multicollinearity, and logistic assumptions were also tested. To determine how well the model suits the data, the Hosmer–Lemeshow goodness-of-fit test was applied.

Results

Participants' characteristics

This study included 132 adult patients with cancer. The patients' ages ranged from 22 to 89 years with mean 53.9 ± 13.7 years. The participants' sociodemographic characteristics are presented in Table 1.

Table 1: Patients' socio-demographic characteristics.

Variable		Total (n = 132)	
		n	%
Age	Below 65	101	77.1
	65 and older	30	22.9
Gender	Male	44	33.3
	Female	88	66.7
Marital status	Single	12	9.10
	Married	103	78.0
	Divorced	7	5.30
	Widowed	10	7.60
Level of education	Primary school	54	40.9
	High school	43	32.6
	Diploma	15	11.4
	Higher education	20	15.2
Working status	Working full-time	22	16.7
	Working part-time	9	6.8
	Not working	92	69.7
	Retired	9	6.80
Family income	<1500 NIS[a]	49	37.4
	1500–3000 NIS	45	34.4
	3000–5000 NIS	25	19.1
	More than 5000 NIS	12	9.20
Smoking	Smoker	22	16.7
	Previous smoker	12	9.10
	Non smoker	98	74.2
Current type of smoking	Cigarette	20	95.2
	Pipe (shisha)	1	4.80

[a] New Israeli Shekel.

Medical history and lifestyle

Figure 1 shows the prevalence of comorbidities among patients. The most common health issues were hypertension (32.6%) and diabetes (28.8%). The least common disease was kidney disease (4.5%).

Regarding patients' physical activity, only 18.9% walked after chemotherapy, compared to 56.1% before. Similarly, 16.7% of patients exercise at home before chemotherapy but only 8.3% exercise after, and 3% exercise at the gym before but only 0.8% after.

Cancer-related data

Of the patients, 58.3% were outpatients. Breast cancer was the most common cancer (34.1%), followed by colon cancer (10.6%), and stomach cancer (7.60%). Of the patients, 46.2% were only administered chemotherapy, 34.8% were treated with chemotherapy and surgery, while chemotherapy, radiotherapy, and surgery were used in 9.8% of cases. The cumulative chemotherapy cycle average was 9.18 ± 4.95, and the current cycle average was 6.71 ± 5.04. Of the patients, 23.8% were in the first cycle, 33.8% in the second, 27.7% in the third, and 14.6% in the fourth. Figure 2 shows the prevalence of the side effects of chemotherapy.

Nutritional status

According to BMI, 40.9% of patients were overweight, 31.1% were normal weight, 22% were obese, and 6.1% were underweight. Biochemical tests revealed that most patients had low haemoglobin (76.3%) and creatinine (66.2%) levels (Table 2). The NRS test revealed that 31 patients (23.8%) were at risk of malnutrition (Figure 3). Table 3 shows the patients' total nutrient intake and coverage of the recommended dietary allowance (RDA).

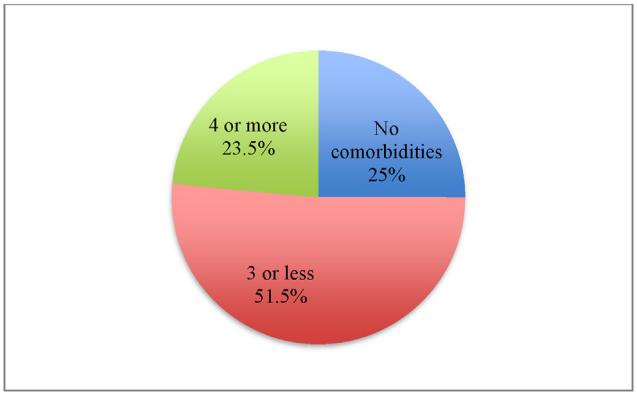

Figure 1: Prevalence of existing comorbidities among patients.

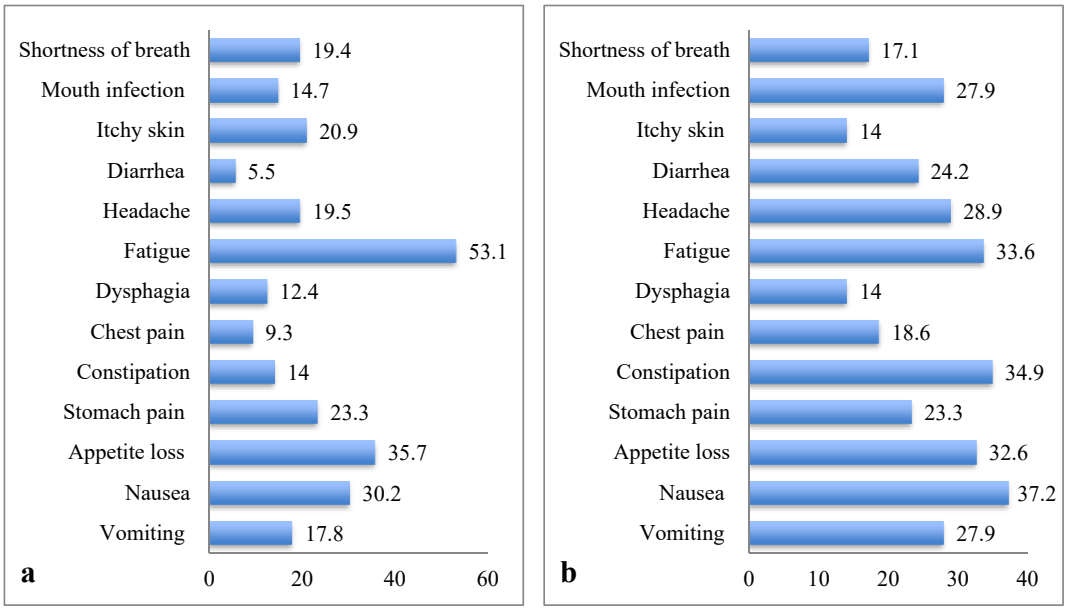

Figure 2: Prevalence of chemotherapy side effects among patients based on frequency (a: always, b: occasionally).

Patients' FAACT scores

The FAACT scores of the patients varied from 41 to 159.83, with an average of 100.28 ± 23.02. The FACT-G scores varied from 38 to 127.83, with a mean of 70.54 ± 15.79. Their A/CS scores ranged from 3 to 48, with an average of 29.73 ± 8.76.

Malnutrition risk and patient characteristics

Table 4 shows the patient characteristics and malnutrition risk relationships. Age was associated with the risk of malnutrition ($p < 0.001$). Patients aged >65 years were at a higher risk. Male gender was associated with the risk of malnutrition ($p < 0.05$). Moreover, smokers (45.5%) and former smokers (33.3%) had higher risks than non-smokers (17.7%).

Malnutrition risk factors

The binary logistic regression analysis showed; The Hosmer and Lemeshow test for the final model showed that goodness of fit of the model was acceptable ($p = 0.518$); Cox & Snell R square was = 0.215; and Nagelkerke R square was = 0.317.

It was found that age >60 years was the only predictor of malnutrition, as shown in Table 5.

Malnutrition risk, cancer, and comorbidities

Inpatients had a higher risk of malnutrition (32.1%) than outpatients (18.2%), but this was not statistically significant ($p = 0.054$). Breast cancer patients had a lower risk (13.3%) than other cancer patients (29.4%), including breast metastatic cancer ($p < 0.05$). Patients with three or fewer comorbidities had a lower risk of malnutrition (17.7%) than those with ≥4 comorbidities (33.3%) ($p < 0.05$).

Table 2: Patients' biochemical levels.

Test (Normal value- lab report)		Total (n = 132)	
		n	%
Albumin (3.5–5.8 g/dl)	Low	25	25.0
	Normal	74	74.0
	High	1	1.00
Haemoglobin (13.5–17.5 g/dl)	Low	100	76.3
	Normal	31	23.7
BUN (10–20 mg/dl)	Low	24	18.5
	Normal	83	63.8
	High	23	17.7
Creatinine (0.8–1.3 mg/dl)	Low	86	66.2
	Normal	33	25.4
	High	11	8.50

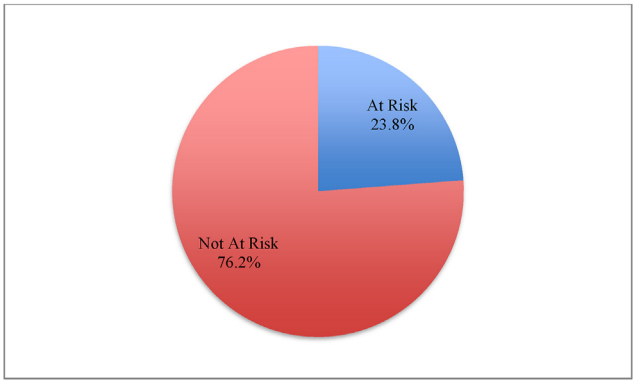

Figure 3: Malnutrition risk among patients.

Table 3: Patients' average daily nutrients intake compared to their RDA.[16]

Variable	Male Intake	%RDA	Female Intake	%RDA
Energy (Kcal)	771 ± 332	–	802 ± 382	–
Protein (g)	42.6 ± 17.9	76.1	41.1 ± 28.8	89.3
Carbohydrate (g)	92.3 ± 42.0	71.0	88.0 ± 40.8	67.7
Fat (g)	26.0 ± 14.1	–	29.8 ± 16.3	–
Fibre (g)	8.81 ± 3.58	29.4	10.8 ± 4.90	51.3
Cholesterol (mg)	188 ± 161	–	181 ± 135	–
Vitamin A (μg)	795 ± 1119	88.3	707 ± 790	101
Vitamin E (mg)	5.22 ± 3.54	34.8	6.49 ± 4.57	43.3
Vitamin C (mg)	56.0 ± 28.5	62.2	79.4 ± 52.0	106
Sodium (mg)	1287 ± 629	85.8	1074 ± 657	71.6
Potassium (mg)	1141 ± 462	33.6	1451 ± 1251	55.8
Calcium (mg)	249 ± 136	24.9	317 ± 280	26.4
Iron (mg)	5.51 ± 2.26	68.9	5.84 ± 3.47	73.0
Zinc (mg)	4.57 ± 2.80	41.5	4.77 ± 3.86	59.6

Table 4: Relationship between malnutrition risk and patient characteristics.

Variable		Total (n = 132)		NRS		*p*-value
		n	%	Risk (%)	No risk (%)	
Age	Below 65	101	77.1	14	86	<0.001**
	65 and older	30	22.9	58.6	41.4	
Gender	Male	44	33.3	34.9	65.1	0.03*
	Female	88	66.7	18.4	81.6	
Marital Status	Single	12	9.1	25	75	0.90
	Married	103	78	23.8	76.2	
	Divorced	7	5.3	14.3	85.7	
	Widowed	10	7.6	30	70	
Level of education	Primary school	54	40.9	23.1	76.9	0.70
	High school	43	32.6	25.6	74.4	
	Diploma	15	11.4	13.3	86.7	
	Higher education	20	15.2	30	70	
Working status	Working full-time	22	16.7	18.2	81.8	0.10
	Working part-time	9	6.8	11.1	88.9	
	Not working	92	69.7	23.3	76.7	
	Retired	9	6.8	55.6	44.4	
Family income	<1500 NIS	49	37.4	20.4	79.6	0.73
	1500–3000 NIS	45	34.4	27.9	72.1	
	3000–5000 NIS	25	19.1	28	72	
	More than 5000 NIS	12	9.2	16.7	83.3	
Smoking	Smoker	22	16.7	45.5	54.5	0.02*
	Previous smoker	12	9.1	33.3	66.7	
	Non smoker	98	74.2	17.7	82.3	
Type of smoking	Cigarette	25	92.6	48	52	0.74
	Pipe (shisha)	2	7.4	50	50	

*$p < 0.05$, **$p < 0.001$ using one-way ANOVA/independent t-test.

Table 5: Malnutrition risk factors.

Factors	*p*-value	Exp (B)[a]	Confidence Interval	Exp(B)[a]	p-value
Age >60 years	0.03*	1.844	(1.07–3.19)	1.10	<0.001**
Comorbidities >3	0.21	1.33	(1.05–5.19)		
Male sex	0.14	1.17	(1.22–5.84)		
Cancer stage (3 or 4)	0.08	1.50	(1.27–7.89)		
Smokers (current & previous)	0.06	2.10	(0.79–2.29)		

*$p < 0.05$, **$p < 0.001$ using binary logistic regression.
[a] Exponentiation of the B coefficient.

Table 6: Patients FAACT scores and malnutrition risk.

	Risk	No risk	*p*-value
FAACT	93.92 ± 21.46	102.27 ± 23.46	0.08
FACT-G	65.67 ± 13.7	72.04 ± 16.3	0.05
A/CS	28.26 ± 8.7	30.23 ± 8.86	0.28

Using independent t-test.

NRS and FAACT scores

Patients with malnutrition risk had lower FAACT, FACT-G, and A/CS scores. However, the difference between the patients' scores was not significant (Table 6).

FAACT scores and nutritional status

The data revealed no association between BMI and FAACT results. Patients with low albumin levels had lower FAACT, FACT-G, and A/CS mean scores ($p < 0.001$). Patients with low BUN had higher FAACT and FACT-G scores ($p < 0.05$) than those with high BUN.

Discussion

Prevalence of malnutrition among cancer

The NRS test reveals a 23.8% malnutrition risk. Two studies with larger samples found a higher prevalence (33.9%, 36.4%,[17] and 52.9%[18]). The variation in malnutrition risk may be due to patient health, cancer status, and sample size.

Malnutrition risk factors

Socio-demographic factors

Patients aged 65 years and above had a higher risk of malnutrition (85.6%) than younger patients (14%) ($p < 0.001$). The logistic regression model gave more weight to being 60 or older ($p < 0.05$). Previous research has found that older cancer patients are at risk of malnutrition.[19,20] Physiological, behavioural, economic, and environmental factors contribute to nutritional inadequacy in the elderly.[21] These factors, which normally decline with age, are likely to increase the risk of malnutrition.

In our sample, men had a higher risk of malnutrition (34.9%) than women ($p < 0.05$) (18.4%). In two studies, male cancer patients were more likely than females to be malnourished.[22,23] In this research project, female participants met daily nutrient needs better than men. In Arabic culture, women spend more time at home and are usually in charge of housework. Social differences (e.g. family support) between genders may also explain this finding.

Lifestyle factors

Smoking increases the risk of malnutrition ($p < 0.05$). Smokers (45.5%) and ex-smokers (33.3%) had a higher risk of malnutrition than non-smokers (17.7%). Similarly, patients with cancer who smoke have a higher risk of malnutrition.[20] A study that used patient-generated subjective global assessment (PGSGA) to identify malnourished cancer patients found that smokers and ex-smokers (79%) had more malnutrition than non-smokers (63%).[22] This could be due to the pro-inflammatory and appetite-suppressing effects of smoking.[23]

Health related factors

Patients with four or more comorbidities were subject to a 33.3% higher risk of malnutrition than those with none or three or fewer comorbidities (17.7%) ($p < 0.05$). In patients undergoing continuous ambulatory peritoneal dialysis (CAPD), the relative risk of malnutrition is significantly higher in patients with comorbidities.[24] Comorbidities increase stress in critically ill patients, such as patients with cancer, making it difficult to meet nutritional requirements.

Malnutrition and functional status

Malnourished patients had lower FAACT scores, although the difference was not statistically significant. The mental and physical quality of life of elderly people at risk of malnutrition was found to be lower than those who were not at risk.[25]

Conclusion

The study sample revealed a considerable prevalence of malnutrition risk. Patients who are not at risk of malnutrition have a slightly better functional status than those who are not. Being a sexagenarian (or older) is another defining factor of malnutrition risk. Other malnutrition risk factors included being 65 or older, male, current or former smoker, and having four or more comorbidities. Cancer patients, especially the elderly and those with multiple comorbidities, should be regularly screened for malnutrition. Most importantly, patients who are at risk need early intervention.

Source of funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest

The authors have no conflict of interest to declare.

Ethical approval

The Palestinian Polytechnic University/Research Committee provided ethical approval for the study protocol (Ref. no. KA/41/2019, Date: 16-11-2019). Consent for publication of this study has been obtained from the patients.

Authors contributions

M.B. drafted the study proposal and protocol. M.H. approved the study protocol, managed ethical issues, supervised data collection, and wrote the report. R.A. was responsible for data management, analysis, and writing. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

References

1. Soeters P, Bozzetti F, Cynober L, Forbes A, Shenkin A, Sobotka L. Defining malnutrition: a plea to rethink. **Clin Nutr 2017 Jun**; 36(3): 896–901.
2. Saunders J, Smith T. Malnutrition: causes and consequences. **Clin Med J R Coll Physicians London 2010 Dec**; 10(6): 624–627.
3. Walsh D, Szafranski M, Aktas A, Kadakia KC. Malnutrition in cancer care: time to address the elephant in the room. **J Oncol Pract 2019 Jul**; 15(7): 357–359.
4. Santarpia L, Contaldo F, Pasanisi F. Nutritional screening and early treatment of malnutrition in cancer patients. **J Cachexia Sarcopenia Muscle 2011 Mar**; 2(1): 27–35.
5. Norman K, Pichard C, Lochs H, Pirlich M. Prognostic impact of diseaserelated malnutrition. **Clin Nutr 2008 Feb**; 27(1): 5–15.
6. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. **CA Cancer J Clin 2021 May**; 71(3): 209–249.
7. *Palestinian Health Information Centre (PHIC) Ministry of Health*. Health Annual Report Palestine; 2017.
8. *Cancer incidence in the Gaza Strip Facts & Figures, moh.gov.-ps.[Internet]*; 2015–2016. c2018. [cited 2021 Mar 15]. Available from: http://www.moh.gov.ps/portal/wpcontent/uploads/2018/07/CANCER-IN-GAZA-2015-2016.pdf.
9. Kondrup J, Ramussen HH, Hamberg O, Stanga Z, Camilo M, Richardson R, et al. Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. **Clin Nutr 2003**; 22(3): 321–336.
10. Ackerman D, Laszlo M, Provisor A, Yu A. Nutrition management for the head and neck cancer patient. In: Maghami E, Ho AS, editors. *Multidisciplinary Care of the Head and Neck Cancer Patient [Internet]*. Cham: Springer International Publishing; 2018. pp. 187–208. https://doi.org/10.1007/978-3-319-65421-8_11. Available from:.
11. Gebremedhin TK, Cherie A, Tolera BD, Atinafu BT, Demelew TM. Prevalence and risk factors of malnutrition among adult cancer patients receiving chemotherapy treatment in cancer center, Ethiopia: cross-sectional study. **Heliyon 2021 Jun 21**; 7(6): e07362.
12. Pourhoseingholi MA, Vahedi M, Rahimzadeh M. Sample size calculation in medical studies. **Gastroenterol Hepatol Bed Bench 2013**; 6(1): 14–17.
13. Lee RD, Nieman DC. *Nutritional assessment*. McGraw-Hill; 2003. 2010. (chapter 3, Page: 74–82).
14. Shim J, Oh K, Kim H. Dietary assessment methods in epidemiologic studies. **Epidemiol Health 2014 Jul**; (36): 1–6.
15. Gelhorn HL, Gries KS, Speck RM, Duus EM, Bourne RK, Aggarwal D, et al. Comprehensive validation of the functional assessment of anorexia/cachexia therapy (FAACT) anorexia/cachexia subscale (A/CS) in lung cancer patients with involuntary weight loss. **Qual Life Res 2019 Jun**; 28(6): 1641–1653.
16. *Nutrient Recommendations: Dietary Reference Intakes (DRI) [Internet]*. National Institutes of Health (NIH); 2021 [cited 2021 Feb 17]. Available from: https://ods.od.nih.gov/HealthInformation/Dietary_Reference_Intakes.aspx.
17. Planas M, Álvarez-hernández J, León-sanz M, Celaya-pérez S, Araujo K, Lorenzo AG De. Prevalence of hospital malnutrition in cancer patients: a subanalysis of the PREDyCES® study. **Support Care Cancer 2016 Jan**; 24(1): 429–435.
18. Park JS, Kim H, Jeung H-C, Kang SA. Association between early nutritional risk and overall survival in patients with advanced pancreatic cancer: a single center retrospective study. **Clinical Nutriton ESPEN 2019 Apr**; 30: 94–99.
19. Starr KNP, McDonald SR, Bales CW. Nutritional vulnerability in older adults: a continuum of concerns. **Physiol Behav 2015 Jun**; 4(2): 176–184.
20. Kaduka LU, Bukania ZN, Opanga Y, Mutisya R, Korir A, Thuita V, et al. Malnutrition and cachexia among cancer outpatients in Nairobi, Kenya. **J Nutr Sci 2017**; 6(e63): 1–10.
21. Pressoir M, Desné S, Berchery D, Rossignol G, Poiree B, Meslier M, et al. Prevalence, risk factors and clinical implications of malnutrition in french comprehensive cancer centres. **Br J Cancer 2010 Mar**; 102(6): 966–971.
22. De Melo Silva FR, De Oliveira MGOA, Souza ASR, Figueroa JN, Santos CS. Factors associated with malnutrition in hospitalized cancer patients: a cross-sectional study. **Nutr J 2015 Dec**; 14(1): 1–8.
23. Cochrane WJ, Afolabi OA. Investigation into the nutritional status, dietary intake and smoking habits of patients with chronic obstructive pulmonary disease. **J Hum Nutr Diet 2004 Feb**; 17(1): 3–11.
24. Prasad N, Gupta A, Sinha A, Sharma RK, Saxena A, Kaul A, et al. Confounding effect of comorbidities and malnutrition on survival of peritoneal dialysis patients. **J Ren Nutr 2010 Nov**; 20(6): 384–391.
25. Gezer C, Yurt M, Harmancioğlu B, Yildirim A, Elmas C. The relationship between malnutrition, diet quality and health-related quality of life among the elderly: a cross-sectional study. **Prog Nutr 2020**; 22(4). 0–000.

How to cite this article: Hamdan MH, Badrasawi MM, Abu Alwafa RW. Nutrition and functional status among Palestinian cancer patients receiving chemotherapy. J Taibah Univ Med Sc 2022;17(2):264–270.