CLINICAL SCIENCE OF NUTRITION

Original Article

DOI: 10.5152/ClinSciNutr.2023.23060

Protein Energy Intake in Hospitalized Cancer Patients: Point Prevalence Research

Arif Timuroğlu[1], Sadet Menteş[1], Selda Muslu[1], Süheyla Ünver[1], Serda Meral Çelebi[2], Kadriye Uzunoğlu[3]

[1]Department of Anesthesiology and Reanimation, University of Health Sciences, Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital, Ankara, Turkey
[2]Department of Nutrition and Dietary, University of Health Sciences, Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital, Ankara, Turkey
[3]Department of Nursing, University of Health Sciences, Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital, Ankara, Turkey

Cite this article as: Timuroğlu A, Menteş S, Muslu S, Ünver S, Çelebi SM, Uzunoğlu NK. Protein energy intake in hospitalized cancer patients: point prevalence research. *Clin Sci Nutr.* 2023;5(2):70-75.

ABSTRACT

Objective: Malnutrition is a common complication in cancer patients that can adversely affect treatment outcomes and quality of life. The aim of this study was to assess the prevalence of malnutrition in inpatient cancer patients and evaluate the impact of nutritional support on their dietary intake.
Methods: A cross-sectional study was conducted on 71 inpatient cancer patients. Nutritional status was assessed using the Subjective Global Assessment tool. Patients were divided into 2 groups based on whether or not they received nutritional support during their hospital stay. Dietary intake was assessed using a 24-hour dietary recall.
Results: The prevalence of malnutrition in our study population was 78.9%. Patients who did not receive nutritional support had a significantly lower intake of both protein and energy compared to those who did receive nutritional support ($P < .001$). The SGA score was significantly correlated with protein intake ($r=0.342$, $P < .001$) and energy intake ($r=0.283$, $P < .001$).
Conclusion: Our study highlights the high incidence of malnutrition in inpatient cancer patients, with almost 80% of patients experiencing malnutrition. Nutritional support was found to have a significant impact on dietary intake, with patients who received nutritional support having a higher intake of protein and energy. These findings emphasize the importance of nutritional screening and support for cancer patients, particularly those at higher risk of malnutrition. Further research is needed to determine the most effective strategies for providing nutritional support to cancer patients and improving their nutritional outcomes.

Keywords: Cancer, malnutrition, nutritional assessment

INTRODUCTION

Cancer patients are at a significantly higher risk of malnutrition, as the disease itself and the treatments utilized can worsen the nutritional status of patients. Malnutrition among cancer inpatients can lead to numerous negative outcomes, such as prolonged hospitalization, decreased tolerance and response to treatment, increased complications, and, ultimately, a decrease in overall survival and quality of life.[1] Thus, addressing the issue of malnutrition in cancer patients is of critical importance for optimizing treatment outcomes and improving patient well-being.

Recognizing and addressing malnutrition in cancer patients is paramount for improving their nutritional status and, ultimately, treatment outcomes. Malnutrition can arise from a variety of factors, including disease-related metabolic disorders, insufficient food intake, nausea and vomiting, mucositis, and diarrhea.[2,3] In fact, malnutrition can even manifest at the time of cancer diagnosis and may worsen as the disease progresses and cytotoxic treatments are administered.[4]

Preventive measures aimed at improving the nutritional status of cancer patients should be prioritized in clinical practice. These measures may include early screening and identification of malnutrition, implementing individualized nutritional support strategies, and actively managing symptoms such as nausea, vomiting, and mucositis to promote adequate food intake. By addressing malnutrition in cancer patients, healthcare providers can improve

[1]Preliminary data for this study were presented as a poster presentation at the Turkish Society of Clinical Enteral & Parenteral Nutrition Congress, May 2019

Corresponding author: Arif Timuroğlu, E-mail: ariftimuroglu@yahoo.com

Received: April 26, 2023 Accepted: May 22, 2023
Publication Date: June 12, 2023

System	Score				
	0	1	2	3	4
Respiration					
PaO_2/FIO_2, mmHg (kPa)	≥400 (53.3)	<400 (53.3)	<300 (40)	<200 (26.7) with respiratory support	<100 (13.3) with respiratory support
Coagulation					
Platelets, $\times 10^3$ μL^{-1}	≥150	<150	<100	<50	<20
Liver					
Bilirubin, mg dL^{-1} (μmol L^{-1})	<1.2 (20)	1.2–1.9 (20–32)	2.0–5.9 (33–101)	6.0–11.9 (102–204)	>12.0 (204)
Cardiovascular	MAP ≥ 70 mmHg	MAP < 70 mmHg	Dopamine < 5 or dobutamine (any dose)[a]	Dopamine 5.1–15 or epinephrine ≤ 0.1 or norepinephrine ≤ 0.1[a]	Dopamine > 15 or epinephrine > 0.1 or norepinephrine > 0.1[a]
Central Nervous System (CNS)					
Glasgow Coma Scale score[b]	15	13–14	10–12	6–9	<6
Renal					
Creatinine, mg dL^{-1} (μmol L^{-1})	<1.2 (110)	1.2–1.9 (110–170)	2.0–3.4 (171–299)	3.5–4.9 (300–440)	>5.0 (440)
Urine output, mL per day				<500	<200

FIO_2: fraction of inspired oxygen; MAP: mean arterial pressure; PaO_2: partial pressure of oxygen.
[a]Catecholamine doses are given as $\mu g kg^{-1} min^{-1}$ for at least 1 h.
[b]Glasgow Coma Scale scores range from 3 to 15; higher score indicates better neurological function.

Figure 1. Sequential Organ Failure Assessment (SOFA) score.

treatment efficacy, decrease hospitalization time, and enhance patient quality of life.

It has been observed that a significant proportion of cancer patients fail to meet the recommended protein intake of 1.2-1.5 g/kg/day.[5] Recent guidelines suggest a higher protein intake to improve protein balance and maintain muscle mass, especially in cancer patients.[6] Therefore, it is essential to evaluate the nutritional status of cancer patients undergoing in-hospital treatment and determine the rate at which they achieve the recommended protein and energy targets.

The current research aims to address this important issue by examining the protein and energy intake of cancer patients receiving in-hospital treatment and assessing their nutritional status. This information is critical for developing effective nutritional interventions to improve treatment outcomes and patient quality of life. By understanding the factors that contribute to poor nutritional status in cancer patients, healthcare providers can better tailor interventions to meet the individualized needs of patients and promote optimal nutritional support.

Main Points

- Cancer patients are at risk of malnutrition due to the disease and its treatments, which can lead to negative outcomes such as longer hospital stays, decreased response to treatment, increased complications, and reduced overall survival and quality of life.
- Malnutrition in cancer patients can be caused by various factors such as disease-related metabolic disturbances, inadequate food intake, nausea and vomiting, mucositis, and diarrhea. Malnutrition can occur even at the time of cancer diagnosis and can worsen with disease progression and cytotoxic treatments.
- Preventive measures should be taken to ensure adequate nutrition in cancer patients, such as early screening and diagnosis of malnutrition, implementation of personalized nutrition support strategies, and active management of symptoms such as nausea, vomiting, and mucositis.
- This study aims to provide critical information for developing effective nutrition interventions by examining the protein and energy intake and nutrition status of cancer patients during hospitalization.
- The research findings show that cancer patients do not meet their daily calorie and protein requirements. However, patients receiving nutrition support had higher calorie and protein intake compared to those who did not receive support.

METHODS

To ensure ethical standards were met, the study received approval from the local ethics committee (-). The study included all cancer patients over the age of 18 who received treatment in the internal medicine department and consented to participate. The research team recorded demographic data, anthropometric measurements (height, weight, and arm diameter), and biochemical parameters of patients on the day of the study. The diagnosis of patients, total calories and protein intake in the last 24 hours, additional diseases, and Sequential Organ Failure Assessment (SOFA) values were also documented; the components of the SOFA score are shown in Figure 1.[7] In this study, the Glasgow coma scale (GCS) score was used to evaluate patients' neurological status and to assess whether they had any restrictions on oral intake due to altered consciousness. The team also recorded calorie and protein levels in patients receiving nutritional support, included enteral, parenteral, and both. Nutritional risk was assessed using the Nutritional Risk Screening (NRS)-2002 tool, and malnutrition was

diagnosed using the Subjective Global Assessment (SGA) method, with patients classified as malnourished if admitted as SGA-B and SGA-C.[8,9] The amount of basal calories patients required was calculated using the Schofield equation, and total energy requirements were estimated by multiplying the activity rate with basal energy expenditure.[10,11]

Statistical Analysis

The IBM Statistical Package for the Social Sciences (IBM SPSS Corp., Armonk, NY, USA) 24.0 program was used for statistical analysis, which included frequency analysis of patient distribution and demographic data using descriptive statistics. Mann–Whitney *U* test and chi-square test were utilized to analyze the data, and statistically significant results were determined by a *P* value below .05.

RESULTS

In total, 71 cancer patients over the age of 18 were included from various departments. Demographic data and the diagnoses of the patients are presented in Tables 1 and 2. According to SGA values, 78.9% of the patients were diagnosed with malnutrition (SGA-B and SGA-C). Furthermore, 70.4% of the patients had an NRS score of 3 or above, and 71.8% of patients experienced weight loss in the last 6 months. Of the total group, 38% of patients experienced weight loss of 10% or more in the last 6 months. Among the patients, 65.8% received sufficient calories. The average daily amount of protein received by patients per kilogram was 0.76 grams (Table 3). In total, 22.5% of patients received nutritional support, and these patients received a higher amount of protein per kilogram compared to those without nutritional support.

Patients receiving nutritional support had a lower body mass index (BMI), whereas SOFA and GCS values were independent of nutritional support. Patients with NRS-3 or above received more nutritional support. However, co-morbid diseases, the type of tumor (solid vs. hematologic), and metastasis involvement did not have an effect on the rate of receiving nutritional support (Table 4).

Table 1. Demographic Data of Patients

	Mean (SD)
Age (years)	**54.1 (15.5)**
Female	53.5 (17.1)
Male	54.6 (14.5)
Weight (kg)	**70.1 (13.6)**
Female	67.4 (14.6)
Male	72.9 (12.5)
Height (cm)	**166.5 (9.5)**
Female	157.9 (6.5)
Male	172.1 (6.4)
BMI (kg/m²)	**25.6 (5.1)**
Female	27.0 (5.6)
Male	24.6 (4.6)

Female, n=28; male, n=43.
BMI, body mass index.

Table 2. Diagnose of Patients

Type of Malignancy	Frequency, n	%
Lung	8	11.1
Acute lymphoblastic leukemia	2	2.8
Acute myeloid leukemia	13	18.1
Rhabdomyosarcoma	1	1.4
Brain	2	2.8
Hypopharynx cancer	1	1.4
Hodgkin lymphoma	1	1.4
Liver	1	1.4
Colon	1	1.4
Larynx	1	1.4
Myelodysplastic syndrome	1	1.4
Breast	6	8.3
Bladder	1	1.4
Stomach	2	2.8
Multiple myeloma	1	1.4
Nasopharynx	2	2.8
Non-Hodgkin lymphoma	8	11.1
Oropharynx	1	1.4
Osteosarcoma	2	2.8
Esophagus	1	1.4
Pancreas	5	6.9
Parotid	1	1.4
Prostate	1	1.4
Rectum	5	6.9
Gall bladder	2	2.8
Cervical	1	1.4
Testis	1	1.4

Table 3. Daily Protein and Energy Intake Values	
	Mean (SD)
Daily calorie needs (kcal)	**2278 (350)**
Female	2031 (230)
Male	2439 (321)
Total calories taken (kcal)	**1476 (559)**
Female	1354 (522)
Male	1555 (574)
Goal to reach calories (%)	**65.8**
Female	66.9
Male	65.2
Total protein taken (g)	**51.3 (24.0)**
Female	46.7 (20.1)
Male	54.3 (25.6)
Protein/weight (g/kg)	**0.76 (0.41)**
Female	0.74 (0.44)
Male	0.77 (0.40)
Female, n=28; male, n=43.	

DISCUSSION

Our study revealed that inpatient cancer patients are not meeting their daily calorie and protein requirements. However, patients who received nutritional support had higher calorie and protein intake compared to those who did not receive nutritional support.

The incidence of malnutrition in cancer patients varies widely depending on several factors such as age, cancer type, and stage of cancer, with rates reported between 20% and 90% in the literature.[12–14] In our study, we found that 70.4% of the patients had experienced weight loss in the last 6 months and that 78.9% of the patients were malnourished based on the SGA values for malnutrition (Figure 2). This malnutrition rate is consistent with previous reports in the literature.

Indirect calorimetry is the recommended method for calculating the total energy needs of cancer patients who are at risk for malnutrition.[15] However, if indirect calorimetry is not available, the European Society for Clinical Nutrition and Metabolism (ESPEN) guidelines suggest that other methods can be used.[6,16] In our study, we used the Schofield equation and activity rates to calculate the daily energy requirement of the patients, which was 2278 kcal.

Table 4. Nutritional Support for Patients			
	Nutritional Support		***P***
	Yes (n=16)	**No (n=55)**	
BMI (kg/m^2)	22.6 (4.1)	26.4 (5.1)	.008
Weight loss in the last 6 months (%)	10.8 (6.1)	8.2 (9.3)	.29
Total protein (gram)	75.4 (26.8)	44.3 (18.0)	<.001
Protein/weight (gr/kg)	1.24 (0.51)	0.61 (0.24)	<.001
Goal to reach calories (%)	76.7 (26.8)	62.7 (24.5)	.17
SOFA	0.44 (0.81)	0.18 (0.48)	.25
GCS	15	15	1.0
NRS < 3 (%)	4.8	95.2	.027
NRS ≥ 3 (%)	30.0	70.0	
Patient with comorbidity (%)	22.6	77.4	1.0
Patient without comorbidity (%)	22.5	77.5	
Patient with solid tumor/ without hematologic cancer (%)	28.9	71.1	.164
Patient without solid tumor/patient with hematologic cancer (%)	11.5	88.5	
Patient with metastasis (%)	27.8	72.2	.531
Patient without metastasis (%)	20.8	79.2	
Values are mean results. BMI, body mass index; GCS, Glasgow Coma Scale; NRS, Nutritional Risk Screening; SOFA, Sequential Organ Failure Assessment.			

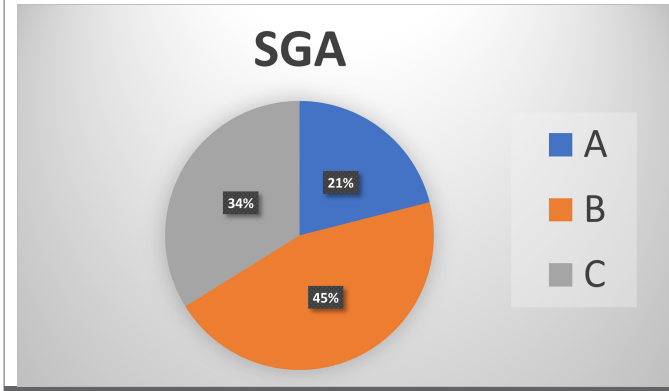

Figure 2. Distribution of patients' SGA values. SGA, Subjective Global Assessment.

However, the patients only consumed 1476 kcal, resulting in a rate of reaching the targeted calories of 65.8%. Patients who received nutritional support had a higher success rate of achieving the target calorie intake, with a rate above 75%.

There is no clear consensus on the optimal amount of protein that cancer patients should consume. However, the general recommendation is to consume at least 1 g/kg/day of protein, with a targeted protein intake of 1.2-2 g/kg/day.[17] In our study, we found that the average protein intake of the patients was only 0.76 g/kg/day. However, when patients received nutritional support, their protein intake increased to 1.24 g/kg/day. It is important to note that insufficient protein intake not only leads to loss of skeletal muscle but also affects metabolism. A study by Stobaus et al[18] demonstrated that cancer patients who consumed less than 1 g/kg/day of protein had 3.3 times higher 6-month mortality rate. The study also emphasized the importance of providing nutritional support to patients receiving chemotherapy.

According to our study, we observed that patients who received nutritional support had a lower BMI compared to those who did not receive nutritional support (22.6-26.4). We hypothesized that patients with a higher BMI may not have been diagnosed with malnutrition as they may not have experienced significant weight loss. This may have led to these patients being overlooked for nutritional support. Furthermore, research conducted by Pressoir et al[19] has shown that obese patients have an increased risk of malnutrition. Similarly, Prado et al[20] found that sarcopenia, a condition characterized by loss of muscle mass and strength, may also be associated with obesity. Therefore, we believe that nutritional support should not be ignored in patients with a relatively high BMI.

In conclusion, our study highlights a high incidence of malnutrition, with 78.9% of inpatient cancer patients experiencing malnutrition. We found that patients who did not receive nutritional support had a lower intake of both protein and energy compared to those who did receive nutritional support. Our findings suggest that providing nutritional support may be crucial in helping patients achieve their targeted nutritional values.

These results are consistent with previous research on the importance of nutritional support for cancer patients. Given the high prevalence of malnutrition in this population, it is important for healthcare providers to prioritize nutritional screening and support for cancer patients, particularly those at higher risk. Future studies may explore the most effective strategies for providing nutritional support to cancer patients and improving their nutritional outcomes.

By conducting a comprehensive evaluation of the nutritional status of cancer patients receiving in-hospital treatment, this study provides valuable insights into the factors that contribute to malnutrition in this population. The detailed measurements and assessments performed in this study enable a more individualized and tailored approach to nutritional interventions, ultimately leading to improved treatment outcomes and enhanced patient well-being.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of University of Health Sciences Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital (Date: January 7, 2019, number: 189).

Informed Consent: Written informed consent was obtained from each patient who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – A.T., S.M.; Design – A.T., S.M.; Supervision – S.Ü.; Resources – A.T., S.M., S.M.; Materials – A.T., S.M., S.M.; Data Collection and/or Processing – S.M.Ç., K.U.; Analysis and/or Interpretation – A.T.; Literature Search – A.T.; Writing Manuscript – A.T.; Critical Review – S.Ü., S.M.

Declaration of Interests: The authors declare that they have no competing interest.

Funding: There was no financial support or sponsorship provided for this study.

REFERENCES

1. Planas M, Álvarez-Hernández J, León-Sanz M, et al. Prevalence of hospital malnutrition in cancer patients: A sub-analysis of the PREDyCES® study. *Support Care Cancer*. 2016;24(1):429-435. [CrossRef]
2. Van Cutsem E, Arends J. The causes and consequences of cancer-associated malnutrition. *Eur J Oncol Nurs*. 2005;9(suppl 2):S51-S63. [CrossRef]
3. Nicolini A, Ferrari P, Masoni MC, et al. Malnutrition, anorexia and cachexia in cancer patients: a mini-review on pathogenesis and treatment. *Biomed Pharmacother*. 2013;67(8):807-817. [CrossRef]
4. Tong H, Isenring E, Yates P. The prevalence of nutrition impact symptoms and their relationship to quality of life and clinical outcomes in medical oncology patients. *Support Care Cancer*. 2009;17(1):83-90. [CrossRef]
5. Deutz NEP, Safar A, Schutzler S, et al. Muscle protein synthesis in cancer patients can be stimulated with a specially formulated medical food. *Clin Nutr*. 2011;30(6):759-768. [CrossRef]

6. Arends J, Bachmann P, Baracos V, et al. ESPEN guidelines on nutrition in cancer patients. *Clin Nutr*. 2017;36(1):11-48. [CrossRef]
7. Vincent JL, Moreno R, Takala J, et al. The SOFA (Sepsis-Related Organ Failure Assessment) score to describe organ dysfunction/failure. On behalf of the Working Group on Sepsis-Related Problems of the European Society of Intensive Care. *Intensive Care Med*. 1996;22(7):707-710. [CrossRef]
8. Kondrup J, Allison SP, Elia M, Vellas B, Plauth M, Educational and Clinical Practice Committee, European Society of Parenteral and Enteral Nutrition (ESPEN). ESPEN guidelines for nutrition screening 2002. *Clin Nutr*. 2003;22(4):415-421. [CrossRef]
9. Detsky AS, Mclaughlin JR, Baker JP, et al. What is subjective global assessment of nutritional status?. *JPEN J Parenter Enteral Nutr*. 1987;11(1):8-13. [CrossRef]
10. Schofield WN. Predicting basal metabolic rate, new standards and review of previous work. *Hum Nutr Clin Nutr*. 1985;39(suppl 1):5-41.
11. Vaz M, Karaolis N, Draper A, Shetty P. A compilation of energy costs of physical activities. *Public Health Nutr*. 2005;8(7A):1153-1183. [CrossRef]
12. Hébuterne X, Lemarié E, Michallet M, De Montreuil CB, Schneider SM, Goldwasser F. Prevalence of malnutrition and current use of nutrition support in patients with cancer. *JPEN J Parenter Enteral Nutr*. 2014;38(2):196-204. [CrossRef]
13. Wie GA, Cho YA, Kim SY, Kim SM, Bae JM, Joung H. Prevalence and risk factors of malnutrition among cancer patients according to tumor location and stage in the National Cancer Center in Korea. *Nutrition*. 2010;26(3):263-268. [CrossRef]
14. Dewys WD, Begg C, Lavin PT, et al. Prognostic effect of weight loss prior to chemotherapy in cancer patients. Eastern Cooperative Oncology Group. *Am J Med*. 1980;69(4):491-497. [CrossRef]
15. Purcell SA, Elliott SA, Baracos VE, Chu QSC, Prado CM. Key determinants of energy expenditure in cancer and implications for clinical practice. *Eur J Clin Nutr*. 2016;70(11):1230-1238. [CrossRef]
16. Arends J, Baracos V, Bertz H, et al. ESPEN expert group recommendations for action against cancer-related malnutrition. *Clin Nutr*. 2017;36(5):1187-1196. [CrossRef]
17. Baracos VEMeeting the Amino Acid Requirements for Protein Anabolism in Cancer Cachexia. *In: Mantovani Giovanni and Anker SD and IA and MJE and FFR and SD and SMW and YSS, ed. Cachexia and Wasting: A Modern Approach* Springer Milan; 2006:631-634. doi:10.1007/978-88-470-0552-5_60.
18. Stobäus N, Müller MJ, Küpferling S, Schulzke JD, Norman K. Low recent protein intake predicts cancer-related fatigue and increased mortality in patients with advanced tumor disease undergoing chemotherapy. *Nutr Cancer*. 2015;67(5):818-824. [CrossRef]
19. Pressoir M, Desné S, Berchery D, et al. Prevalence, risk factors and clinical implications of malnutrition in french comprehensive cancer centres. *Br J Cancer*. 2010;102(6):966-971. [CrossRef]
20. Prado CM, Cushen SJ, Orsso CE, Ryan AM. Sarcopenia and cachexia in the era of obesity: clinical and nutritional impact. *Proc Nutr Soc*. 2016;75(2):188-198. [CrossRef]