World Nutrition Journal |eISSN 2580-7013

ORIGINAL ARTICLE

Evaluation of the prevalence, and relationship between nutritional status, malnutrition, and quality of life in cancer patients undergoing chemotherapy in Mashhad, Iran in 2023

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Received 15 December 2024
Accepted 30 January 2025
Published 28 February 2025

Link to DOI:
10.25220/WNJ.V08.i2.0006

Citation: Zeyghami A, Moghadam H K, Babaei A, Bari A R, Shahraki S H, Shahidsales S, Dahri M. Evaluation of the prevalence, and relationship between nutritional status, malnutrition, and quality of life in cancer patients undergoing chemotherapy in Mashhad, Iran in 2023. World Nutrition Journal.2025 February 28,8(i2): 45-54.

Abstract

Introduction: Cancer patients face high risks of malnutrition, low muscle mass, and sarcopenia due to decreased intake and treatment side effects. This malnutrition can lead to longer hospital stays, higher mortality, lower quality of life, and poor treatment tolerance. The purpose of this study is to evaluate the prevalence and relationship between nutritional status, malnutrition and quality of life in cancer patients undergoing chemotherapy in Mashhad, Iran in 2023.

Method: In a cross-sectional study, we evaluated 237 cancer patients from Razavi, Nazeran, Qhaem, and Omid Hospitals using the Patient-Generated Subjective Global Assessment (PG-SGA). Data analysis was conducted with SPSS version 21.

Results: Among the 237 patients assessed, 61.6% were identified as female. The PG-SGA scores indicated that the prevalence of malnutrition and the risk of malnutrition were 89.9% (n=213) and 7.2% (n=17), respectively. Our findings revealed significant differences in physical function, role function, and emotional status dimensions between the malnourished group and the normal/at-risk malnutrition group ($P < 0.001$). In contrast, no significant differences were found in cognitive function and social function. Furthermore, there were significant variations in fatigue, pain, and appetite levels between the malnourished group and the normal/at-risk malnutrition group, as assessed by the QoL questionnaire.

Conclusion: It was determined that 89.9% of cancer patients across all treatment modalities were malnourished and required immediate care. Gastrointestinal cancer was found to have the highest malnutrition rates when compared to other cancer types.

Keywords: malnutrition, chemotherapy, PG-SGA, quality of life

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Introduction

Cancer is the second leading cause of death in the world.[1,2] The prevalence of cancer is increasing, with an estimated 19.3 million new cases and 10 million cancer-related deaths in 2020 alone.[3] The prevalence of malnutrition in cancer patients is 40 to 80 percent. Almost 20% of cancer deaths are due to malnutrition in these patients, not the disease itself.[4] It also affects quality of life, reduced immune response, treatment and survival, length of hospital stays, and patient costs. Complications of malnutrition, including weakness and lethargy, affect the daily activities of patients and reduce the quality of life of these people.[3,5,6]

There are various treatment methods for cancer patients based on the individual's specific cancer type, stage, general health, and overall medical history, which include surgery, chemotherapy, radiotherapy, or a combination of them. Chemotherapy is a critical treatment option for cancer patients, involved in killing cancer cells or slowing down their growth. The prevalence of chemotherapy varies depending on the type and stage of cancer. According to research reports, approximately 60% of cancer patients receive chemotherapy as part of their treatment regimen.[3] Chemotherapy treatment can result in several nutritional side effects include nausea, vomiting, loss of appetite, taste alterations, difficulty swallowing, and gastrointestinal problems.[7,8] Some studies reported that 45-55% of patients undergoing chemotherapy were malnourished.[9-11] A study by Ravasco et al.[12] examined the nutritional status of colon cancer patients undergoing chemotherapy. The results showed that body weight, body mass index (BMI), and muscle mass decreased significantly during the treatment period and a high percentage of them experienced protein-energy malnutrition. Another study by Isenring et al.[13] focused on the nutritional status of patients with head and neck cancer receiving chemotherapy. The findings revealed that these patients experienced significant weight loss and a decline in dietary intake during treatment. High prevalence of weight and muscle loss also found in lung cancer patients undergoing chemotherapy.[8]

Also, chemotherapy affects the quality of life of patients. Quality of life includes various aspects including physical, mental, social, and emotional well-being. Understanding and addressing factors affecting the quality of life in cancer patients undergoing chemotherapy is very important to provide comprehensive care and improve patient outcomes.[14-16]

Given the high prevalence of malnutrition and its crucial role in treatment process of patients undergoing chemotherapy, the present study was conducted with the aim of investigating the prevalence and relationship between nutritional status, malnutrition and quality of life in cancer patients undergoing chemotherapy in Mashhad, Iran in 2023.

Material and Methods

Study design and subjects

An analytical cross-sectional study was conducted from January 2023 until March 2023 in the chemotherapy department of Razavi, Nazeran, Ghaem, and Omid Hospitals in Mashhad, Iran. The subjects were 237 adult cancer patients undergoing chemotherapy for any type of cancer. The study protocol was approved by Mashhad University of Medical Sciences with approval ID "IR.MUMS.REC.1401.326". Ethical approval was granted to each person, and all the patients gave written consent.

Sample Size

Regarding the malnutrition prevalence of 69% based on the study by Pazzini Maia[17], which uses the same questionnaire, the confidence interval is 95%, and considering a 10% error, the minimum sample size is 192 people, based on the formula to determine the sample size:
$n= z^2 \times p \times (1-p) \div d^2$.

Inclusion and exclusion criteria

The inclusion criteria were adults > 18 years old in both sexes, confirmation of any type of cancer by an oncologist, undergoing at least two cycles of

chemotherapy, access to information on weight changes in the last 6 months, and willingness of the patient to attend the study. The exclusion criteria of the study were unstable clinical conditions, cognitive disorders, and neurodegenerative movement disorders (e.g., Parkinson's disease, stroke, severe myopathy, and severe arthritis).

Nutritional assessment and Quality of life

We used the patient-generated subjective global assessment (PG-SGA) for the Iranian population to measure malnutrition.[18,19] It is a common tool for assessing the risk of malnutrition in oncology and other chronic catabolic settings. Four patient-generated historical components weight history, food intake, symptoms, and activities build up the PG-SGA. Patients were divided into three groups according to their responses to the questionnaire: A (proper nutrition), with a score of 0–1, B (high risk or suspected malnutrition), with a score of 2–8, and C (malnutrition), with a score of 9. Likewise, variables like recent weight loss, dietary changes, complaints about nutrition, physical activity, and clinical observations were surveyed.

The QLQ-C30 version 1.0 (QLQ-C30 (V1)) includes five functional scales (physical, role, cognitive, emotional, and social), three symptom scales (fatigue, pain, and nausea or vomiting), a global health status scale, and several single items assessing additional symptoms frequently reported by cancer patients (dyspnea, decrease in appetite, insomnia, constipation, and diarrhea), as well as the perceived financial impact of the disease. The scores for all scales and single-item measurements range from 0 to 100. A high scale score indicates a higher level of response. So, a high score on a functional scale indicates a high level of functioning that qualifies as healthy, whereas a high score on a global health status scale reveals a high quality of life. However, a high score on a symptom scale shows a more severe problem.[20]

Anthropometric measurements

Participants wearing light clothing without shoes were subjected to an anthropometric measurement. using a scale (Seca 760) and wall-mounted stadiometer (Seca 206 stadiometer, Germany) to the nearest 0.5 kg and 0.5 cm, body weight and height measurements at recruitment. Body mass index (BMI) was computed as weight (in kilograms) divided by height (in meters squared). The percentage of unintentional weight loss over the last 6 months was calculated in the following patient reports.

Statistical Analyses

After collecting the data, it is analyzed by SPSS version 21 statistical software. Providing qualitative data in the form of numbers and percentages and testing with the Chi-square test. Regarding quantitative data, the Kolmogorov-Smirnov test will be used first to measure the normality of the data. The Independent sample t-test and if necessary, a non-parametric equivalent, Mann-Whitney U, will be used. All tests are analyzed at a significance level of $P \leq 0.001$.

Results

Among 237 paints examined, 61.6 % were female. The mean age and weight of participants were 53±81 years, and 65±93 kilograms. The data on the demographic and clinical characteristics of patients are presented in **table 1**.

Prevalence of different cancer types, including female cancer, gastrointestinal (GI), lung, hematology, and other cancers, were 35.9%, 32.9%, 8.4%, 6.8%, and 16%, respectively (**Table 1**). Most of the participants (84%) were patients who had been diagnosed as cancer patients for more than 8 weeks.

The PG-SGA scores indicated that the prevalence of malnutrition and risk of malnutrition among patients were 89.9% (n=213) and 7.2% (n=17) respectively. The nutrition status of patients was significantly different ($P < 0.001$) between the cancer groups (GI cancer was the most with 94.9% malnourished patients) (**table 2**).

Table 1a. Demographic and clinical characteristics of cancer patients undergoing chemotherapy in Mashhad hospitals (n=237)

Variable		Number (%)
Sex	Female	146 (61.6)
	Male	91 (38.4)
Marriage	Unmarried	19 (8)
	Married	188 (79.3)
	Widow	26 (11)
	Divorced	4 (1.7)
Education level	Illiterate	46 (19.4)
	Primary	99 (41.8)
	Diploma	59 (24.9)
	postgraduate	33 (13.9)
Residence	Mashhad	157 (66.2)
	Other Cities	80 (33.8)
Living Arrangements	Alone	15 (6.3)
	With Family	202 (85.2)
	With others	20 (8.4)
Type of Cancer	Female Cancer	85 (35.9)
	GI	78 (32.9)
	Lung	20 (8.4)
	Hematology	16 (6.8)
	Other	38 (16)
Cancer Diagnosis	Less than two weeks	4 (1.7)
	2-8 weeks	34 (14.3)
	More than 8 weeks	199 (84)

Table 1b. Demographic and clinical characteristics of cancer patients undergoing chemotherapy in Mashhad hospitals (n=237)

Treatment History	Chemotherapy	125 (52.7)
	Surgery and Chemotherapy	78 (32.9)
	Radiotherapy and Chemotherapy	20 (8.5)
	Surgery, Chemotherapy, and Radiotherapy	14 (5.9)
Hospital	Omid	41 (17.3)
	Ghaem	80 (33.8)
	Razavi	30 (12.7)
	Nazeran	86 (36.3)

GI: Gastrointestinal

We found that there was a significant correlation between different parts of body fat and muscle mass, and malnutrition in cancer patients undergoing chemotherapy ($p<0.001$) except temporal muscle which was not significant ($p=0.007$). According to the PG-SGA score, a significant 78.9% of patients experience a reduction in fat mass. The areas most affected include the region around the eyes, with 67.6% of patients showing loss, followed closely by the triceps at 67.2%, and the intercostal muscles at 51.6%. In terms of muscle mass reduction across various body regions, the legs are impacted in 70.8% of patients, followed by the calves at 64.8%, shoulders at 64.3%, interosseous muscles at 60.2%, clavicle at 59.2%, scapula at 58.6%, and the temporal region at 47.9%.

In addition to PG-SGA, the QoL questionnaire was completed for all patients. Our finding indicated significant differences between the malnourished group and the normal/at-risk malnutrition group in physical function, Role function, and emotional status dimensions ($P < 0.001$), while no significant differences in cognitive function, and social function were denoted (Table 3). There is a significant difference between the malnourished group and the normal/at-risk malnutrition group in fatigue, pain, and appetite rates as symptoms classified on the QoL questionnaire.

Our findings indicated significant associations between the score of all quality-of-life dimensions and malnutrition status. However, associations between the score of constipation, diarrhea, and the score of malnutrition were not reported due to minor association (R^2).

There is a significant positive correlation between the score of malnutrition and the score of fatigue, nausea / vomiting, pain, dyspnea, Insomnia, Appetite, Constipation, and Diarrhea. Furthermore, there is a significant reverse correlation between the score of malnutrition and the score of physical function, Role function, emotional function, social function, and QoL total score. (**table 4**)

Discussion

According to the findings of this study, 89.9% of cancer patients admitted to Omid, Ghaem, Razavi, and Nazeran hospitals were malnourished, and 7.2% were at risk of malnutrition based on their PG-SGA score which

is consistent with another research on a similar subject. Van Tap n et al.[21] performed a descriptive cross-sectional study on 118 cancer patients who were receiving inpatient care in Vietnam in 2020, and the results revealed an overall malnutrition rate of 84.8%, of which 33.0% had severe malnutrition and 51.7% had mild-moderate malnutrition. According to a 2019 study by Gebremedhin TK et al.[10] among a sample of 281 patients receiving chemotherapy in a cancer center in Ethiopia, 58.4% of adult cancer patients were malnourished. A study done by Shadmand et al.[18] on 113 cancer patients in Mashhad, Iran, demonstrated that the prevalence of severe malnutrition was 96.4%, while a cross-sectional study conducted by Movahed et al.[22] reported the prevalence rate to be 38.5% in cancer outpatients. In one case, Allahyari et al.[23]'s meta-analysis demonstrated that the prevalence of malnutrition among different types of cancer ranged from 44.6 to 98%. In another study, Khoshnevis et al.[24] in Tehran used the PG-SGA to determine the prevalence of malnutrition in 416 cancer patients. According to the aforementioned study, 53.1% of the patients (n=221) had malnutrition, with 29.1% and 24% diagnosed with moderate and severe malnutrition, respectively. Reviewing the earlier mentioned studies, concluded that Iran has a high prevalence rate of malnutrition. Most previous studies in Iran have been conducted on cancer outpatients, whereas our sample population was made up of chemotherapy-treated cancer patients with severe conditions.

Table 2. Nutritional status of cancer patients undergoing chemotherapy based on PG_SGA in Mashhad hospitals (n=237)

Nutritional Status / Cancer type	Normal/At-risk of malnutrition n (%)	Malnourished n (%)	Total number of patients (n)	p-Value
Female Cancer	6 (7.1%)	79 (92.9%)	85	
GI	4 (5.1%)	74 (94.9%)	78	
Lung	3 (15%)	17 (85%)	20	< 0.001
Hematology	7 (43.8%)	9 (56.3%)	16	
Other Cancers	4 (10.5%)	34 (89.5%)	38	

PG-SGA: patient generated-subjective global assessment; GI: Gastrointestinal
Fisher test

Table 3. Comparing the average domains of quality-of-life dimensions according to nutritional status in cancer patients undergoing chemotherapy in Mashhad hospitals (n=237)

Quality of life Dimensions	Nutritional status	Normal/At-risk malnutrition (n=24) (First quartile, Third quartile) median	Malnourished (n=213) (First quartile, Third quartile) median	P-Value
Functional Scale	Physical	(93.3, 80) 86.7	(40, 80) 60	< 0.001
	Role	(66.7, 100) 100	(41.7, 100) 83.3	< 0.001
	Emotional status	(68.7, 91.7) 83.3	(33.3, 79.2) 58.3	< 0.001
	Cognitive	(70.8, 100) 91.7	(50, 100) 83.3	0.087
	Social	(66.7, 100) 100	(33.3, 100) 66.7	0.039
Symptom Scale	Fatigue	(0.0, 22.2) 22.2	(22.2, 77.8) 55.6	< 0.001
	Nausea	(0.0, 12.5) 0.0	(0.0, 16.7) 0.0	0.043
	Pain	(0.0, 16.7) 0.0	(16.7, 66.7) 33.3	< 0.001
	Dyspnea	(0.0, 33.3) 0.0	(0.0, 33.3) 0.0	0.185

	Insomnia	(0.0, 33.3) 0.0	(0.0, 66.7) 33.3	0.023
	Decrease in Appetite	(0.0, 0.0) 0.0	(0.0, 66.7) 33.3	< 0.001
	Constipations	(0.0 , 0.0) 0.0	(0.0 , 66.7) 0.0	0.016
	Diarrhea	(0.0, 0.0) 0.0	(0.0, 0.0) 0.0	0.112
Quality of life		(75, 100) 83.3	(91.7, 58.3) 75	0.009

Qol; Quality of life
Mann-Whitney test

Table 4. Multiple linear regression analysis for the association between malnourished cancer patients undergoing chemotherapy in Mashhad hospitals (n=213) malnourished with QoL dimensions

	Malnourished (R^2)	Malnourished (β (95% CI))	Malnourished (P-value)
Physical function	0.279	-0.79 (-0.98, -0.60)	< 0.001
Role function	0.242	-.94 (-1.17, -0.70)	< 0.001
Emotional function	0.174	-0.66 (-0.89, -0.43)	< 0.001
Cognitive function	-	-0.30 (-0.52, -0.07)	0.01
Social function	0.155	-0.71 (-0.97, -0.45)	< 0.001
Fatigue	0.326	1.03 (0.81, 1.25)	< 0.001
Nausea/vomiting	0.171	0.52 (0.33, 0.71)	< 0.001
Pain	0.202	0.79 (0.54, 1.05)	< 0.001
Dyspnea	0.283	0.45 (0.20, 0.70)	< 0.001
Insomnia	0.128	0.77 (0.45, 1.09)	< 0.001
Appetite	0.301	1.21 (0.95, 1.48)	< 0.001
Constipation	-	0.58 (0.29, 0.86)	< 0.001
Diarrhea	-	0.40 (0.20, 0.60)	< 0.001
Financial difficulty	0.154	0.28 (0.14, 0.42)	< 0.001
Qol	0.169	-0.60 (-0.78, -0.41)	< 0.001

Table 4 Adjusted for age, sex, education, insurance

Numerous studies have found that malnutrition negatively impacts the quality of life (QoL) in cancer patients undergoing chemotherapy.[25,26] Malnutrition may struggle with muscle, cardio-respiratory, and gastrointestinal functions. It also causes weight loss due to depletion of fat and muscle mass, including organ mass. A study conducted by Nakayama et al.[27] indicates that approximately half of individuals with ovarian cancer experience a decline in skeletal muscle mass and fat mass during primary debulking surgery and subsequent chemotherapy, aligning with our observations. Nevertheless, the precise causal relationship underlying this phenomenon remains ambiguous. During periods of simple starvation, the body utilizes fat stores as the primary energy source, leading to a reduction in fat mass that typically occurs prior to muscle loss.[28] Conversely, the depletion of skeletal muscle is a defining characteristic of cancer cachexia.[29] In cases of cachexia, metabolic and inflammatory alterations are triggered, resulting in skeletal muscle wasting that occurs independently of fat mass loss. The advancement of cancer cachexia is associated with a poorer prognosis. Furthermore, research by Halpern et al.[30] indicates that severe nutritional status is the sole factor significantly correlated with fat-free mass (FFM) loss, even after adjustment for tumor location and disease stage. Based on these results,

improving cancer patients' nutritional status may enhance their clinical outcomes and quality of life.

Many research investigations have demonstrated the correlation between the severity of malnutrition in patients and the type, stage, and location of the tumor. In our study, we found GI cancers as the most relevant cancer type to malnutrition. This is mostly due to the decrease in appetite caused by changes in the secretion of digestive hormones from the digestive tract, or changes in digestion, absorption, and less calorie intake. In advance, various studies have suggested that patients with lung cancer and gastrointestinal cancer are at a higher risk of malnutrition.[31,32] In addition to the type of cancer and the body part affected, cancer in the head, neck or gastrointestinal system can affect your ability to swallow or digest your food which causes weight loss and malnutrition.

Studies have suggested that malnutrition, excess body fat, loss of muscle mass, and other symptoms are significantly associated with poor QoL in patients with cancer.[33,34] According to the results, the amount of muscle mass and fat mass reduction was extremely high in cancer patients undergoing chemotherapy based on the PG-SGA scores. The reduction rate of the mass around the eyes and legs was higher than the others. In this study, the difference between QoL and nutritional status was significant in certain domains of QoL: physical, emotional, and role functions in malnourished patients scored less compared to normal and at the risk of malnutrition patients (**table 3**). We did not find any significant difference between cognitive function, social function, and malnutrition in this study, but these connections were occasionally seen in other studies, which could be due to the age difference and economic conditions of the people who participated in our study. A cross-sectional study accomplished by Badrasawi et al.[26] between 2018 and 2019 on chemotherapy patients identified weight loss caused by chemotherapy has a negative impact on physical and social functioning, whereas weight gain with some treatment regimens has a positive impact on emotional and social functioning, these findings were in line with our results. Also, patients experience weakness and often stop their regular activities, which negatively impacts their QoL.[26,35]

The current study found that fatigue, decrease in appetite, and pain were the most frequent complaints among cancer patients (**table 3**). This is consistent with earlier research that suggested the main complaints of cancer patients were anorexia, xerostomia, and pain.[32,36] A study done by Viana et al.[1] concluded anorexia, nausea, constipation, mouth sores, strange tastes, vomiting, dry mouth, swallowing difficulties, pain, and mouth sores were the most frequent symptoms. Controlling these complaints could therefore improve the nutritional intake of cancer patients, though the effects should be carefully examined in future research.

Despite the positive aspects of this study, including its attention to the important issue of malnutrition in cancer patients undergoing chemotherapy, there were still limitations to the study. Heterogeneity of the sample cancer types with different mechanisms of malnutrition and differences in stage and treatment protocols based on dosage and duration, may have confounded the results and influence nutritional and functional outcomes. The measurement of muscle and fat mass was only done via clinical visual inspection which is less accurate in comparison with objective techniques like bioelectrical impedance analysis (BIA) or dual-energy X-ray absorptiometry (DEXA). Also, this study was conducted as an analytical cross-sectional study that only examined the relationship between malnutrition and chemotherapy. If it was possible to follow up patients in longitudinal studies, more useful data could be obtained about the effect of malnutrition in these patients and its role in the treatment process. Through which practical nutritional recommendations can be reached to improve the condition of patients undergoing chemotherapy.

Conclusion

According to our findings, which were based on the PG-SGA, 89.9% of cancer patients in all

treatment settings were malnourished and requiring immediate attention. In contrast to other cancer types, GI cancer had the highest rate of malnutrition. A substantial percentage of patients exhibit a decrease in both fat and muscle mass due to malnutrition, as indicated by the PG-SGA score. Eventually, it strongly encouraged that ongoing nutritional assessment and intervention must be initiated during chemotherapy, which may considerably decrease the prevalence of malnutrition and improve QoL.

Availability of Data and Material

Data and materials used in this study are available upon request. please contact the corresponding author for inquiries regarding access to the dataset and the research materials.

Authors' Contributions

AZ, HK, ARB, and MD designed this study. AZ and HK performed the study and entered data. HK and AB conducted the library search, wrote the manuscript, and drafted and edited the manuscript. AB designed the study tables. SHS participated in the statistical analysis. All authors have read and approved the final manuscript.

Conflict of interest

The authors declare that there are no conflicts of interest.

Funding

This article is funded by grants from Student research committee of Varastegan Institute for Medical Sciences.

Acknowledgments

Furthermore, we would like to express our gratitude to the Varastegan Institute for Medical Sciences, the chemotherapy department of Razavi, Nazeran, Ghaem, and Omid Hospitals, as well as all the participants in this study.

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