World Cancer Research Journal WCRJ 2021; 8: e1925

MALNUTRITION RISK AND RELATED FACTORS IN CANCER PATIENTS UNDERGOING CHEMOTHERAPY: A CROSS-SECTIONAL STUDY

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Abstract – *Objective:* *Cancer can widely influence the nutritional status of the patients, which could exacerbate the related complications and subsequently, counteract the treatment efficiency. Cancer-related malnutrition is one of the most common complications of these patients. Therefore, this research was conducted to evaluate the nutritional status of the patients with cancer by the malnutrition universal screening tool (MUST) questionnaire and implementation of the appropriate interventions in order to improve the quality of life and alleviate the complications.*

Patients and Methods: *This descriptive cross-sectional study was performed on 71 patients with cancer, undergoing chemotherapy, admitted to the Oncology Unit of Shahid Jalil Hospital in Yasuj (Kohgiluyeh and Boyer-Ahmad Province, Iran) from April 22 to May 22, 2019 considering the Ethical issues in data collection (IR.YUMS.REC.1398.004).*

Results: *Results of the study showed a significant relationship between the age and cancer type with malnutrition risk in the patients (p=0.043, p=0.008, respectively). A significant relationship was also found between the gender and risk of malnutrition (p=0.033) so that, 48.65% of men were at high risk for malnutrition, and gastrointestinal and breast cancers were the most frequent types of cancer in this work (42.25 and 28.17%, respectively). Totally, 62% of patients had moderate to severe malnutrition.*

Conclusions: *High prevalence of malnutrition was observed in the studied patients based on the MUST scores. Therefore, timely diagnose of the cancer-related malnutrition and applying the appropriate intervention strategies play a pivotal role in improving the quality of life and decreasing the survival rate of cancer.*

KEYWORDS: *Malnutrition, Cancer, Nutritional status, Nutrition assessment.*

INTRODUCTION

Cancer, as a chronic non-communicable disease caused by the uncontrolled cell growth is mainly influenced by the genetic and environmental factors. It is a major public health problem and the second leading cause of death in the US and the third leading cause of death in Iran[1-3].

Both the nature of cancer and its treatment process put the patients at increasing risk for malnutrition[4]. Based on the existing evidence, prevalence of the cancer-related malnutrition varies in the range of

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25-80% worldwide, depending on the cancer type, disease stage, age, different types of treatment, etc.[5,6]. *Khoshnevis et al*[7], in a study conducted in Iran reported that about 53.1% of the patients with cancer were suffering from the malnutrition. It is estimated that about 50% of the patients with cancer finally die as a result of cancer-associated malnutrition. According to the results obtained from the follow-up studies, malnourished patients with cancer are at about 2- to 5-fold greater risk of death. Multiple factors are related to the cancer-induced malnutrition, which is considerably different from simple starvation including mental health issues[8], poor food intake, dysfunction of gastrointestinal tract, the increase in the energy needs, the decrease in the physical activity, and changes in the metabolism in different organs or tissues[4,5,9]. Tumor-derived cytokines including interleukin 6 (IL-6), interleukin 1(IL-1), tumor necrosis factor alpha (TNF-α), interferon gamma (INF-γ), etc. can disturb the metabolism of macronutrients, suppress the appetite, enhance the muscle wasting, depression and fatigue and subsequently, leading to the impaired physical activity and anorexia[4,8]. This condition can also negatively affect cardiovascular system, mainly due to coagulation dysfunction, thromboembolic events[10] and formation of atherosclerotic plaques as a result of inflammatory cytokines[11].

Muscle cells may also take up the chemotherapy drugs, suppress the protein synthesis and induce the atrophy[9]. Cachexia is another consequence of malnutrition characterized by the rapid weight loss. Its prevalence is estimated to be in the range of 60- 80%[12]. These conditions may worsen the prognosis and lead to the poor quality of life, increased duration of hospital stay, tolerance to treatment, and therapeutic efficacy and ultimately, increased mortality rate. Therefore, the patient's nutritional status has a huge effect on the disease process[6,13]. However, despite the previously discussed adverse effects of undernutrition on the oncologic process and treatment outcome, early and routine nutritional screening and interventions are dramatically neglected by the health care professionals and patients themselves. *Sanz et al*[6] concluded that only about 30-60% of the at-risk patients with cancer received the nutritional treatment[14]. Hence, evaluation of nutritional status at the time of diagnosis and during the treatment is of great importance for early detection of undernutrition and high-risk patients[13].

Thus, the present research was carried out to evaluate the nutritional status of the patients with cancer using the malnutrition universal screening tool (MUST) questionnaire and implementation of the appropriate interventions in order to improve the quality of life just in case.

PATIENTS AND METHODS

This descriptive cross-sectional study was conducted on all the patients with cancer, undergoing chemotherapy, admitted to the Oncology Unit of Shahid Jalil Hospital in Yasuj (Kohgiluyeh and Boyer-Ahmad province, Iran) from April 22 to May 22, 2019. The study protocol was approved by the Ethics Committee of Yasuj University of Medical Sciences (IR.YUMS.REC.1398.004). Yasuj is a province located in the southwest of Iran, in which the prevalence of cancer is increasing, and this is the first time that such a study is conducted in this province.

In this work, 71 patients with a mean age of 55.81±15.10 years old were assessed. An informed written consent was obtained from all the patients and a demographic questionnaire, containing the information about gender, height, weight, age, residence, marital status, level of education, and occupation, was completed for each of them at the beginning of the study. Body weight was measured with minimum clothing and using a Seca scale with an accuracy of 0.1 kg. Height was determined using a Seca stadiometer with an accuracy of 0.01 cm and Body mass index (BMI) was defined as the weight (kg) divided by square of height (kg/m^2). Nutritional status was assessed by the MUST questionnaire. This questionnaire identifying the adults who are malnourished or at risk of malnutrition is widely used in all the clinical settings including the oncology[15]. It is a five-step screening tool validated by the British association for parenteral and enteral nutrition (BAPEN). Its steps are as follows: 1) measuring the weight and height to get a BMI score; 2) making it possible to get weight loss score based on the unintentional weight loss in the past 3-6 months; 3) establishing an acute disease effect score; 4) calculating the overall risk of malnutrition as low (score 0), medium (score 1), and high risk (score ≥2); 5) presenting the management guidelines and local policies for implementing the appropriate interventions[16,17].

Statistical Analysis

Statistical analysis was conducted using the SPSS 23 software (IBM Corp, Armonk, NY, USA). Descriptive statistics were used to report the frequency and percentage for qualitative variables and Mean±SD were applied for quantitative ones. The Chi-Square test and Fisher's exact test were also used to analyze the difference between the qualitative variables. A p-value of <0.05 was considered as statistically significant.

TABLE 1. Anthropometric and demographic characteristics of participants.

Variable	*Category*	*Amounts**
Weight (kg)		67.5 ± 14.00
BMI (kg/m^2)		24.80 ± 5.32
Weight Loss (kg)		4.01 ± 5.14
Age (y)		55.15±81.10
Gender	Female	33 (46.5)
	Male	38 (53.5)
Habitat	Urban	41 (57.7)
	Rural	30 (42.3)
Education	Illiterate	35 (49.3)
	<Diploma	16 (22.53)
	Diploma	8 (11.27)
	Academic educational	12 (16.90)
Occupational status	Unemployed	4 (5.6)
	Householder	30 (42.3)
	Workingman	15 (21.1)
	Self-employment	7 (9.9)
	Employee	6 (8.5)
	Retired	9 (12.7)

*Data presented as mean ± standard deviation or number (percent).

RESULTS

A total of 71 patients with cancer were admitted to the Oncology Unit of Shahid Jalil Hospital in Yasuj, among whom 38 (53.5%) were male and 33 (46.5%) were female. The mean age of the patients was equal to 55.15±81.10 years old with the lowest age of 25 years old and the highest age of 89 years old. Totally, 42.3% of the participants were rural residents and 57.7% were urban residents. The mean weight of the subjects was equal to 67.50 ± 14.00 kg (Table 1).

As shown in Figure 1, gastrointestinal (gastric, colon, rectal, etc.) and breast cancers were the most frequent types of cancer in this work (42.25 and 28.17%, respectively).

In regard to the malnutrition risk, 27 (38.0%) of the patients had zero score (low risk), 20 (28.2%) of the patients had score 1 (medium risk), and 24 (33.8%) of them had score 2 (high risk) (Figure 2).

Findings of this study revealed a significant relationship between the age and malnutrition risk in the patients with cancer (p =0.043) so that, nearly 55% of the patients aged over 65 years old and 27% of the patients aged 18-65 years old had high risk of malnutrition. A significant relationship was also found between the gender and risk of malnutrition (p =0.033) so that, 48.65% of men were at high risk for malnutrition. The patients with gastrointestinal cancer had the highest risk for malnutrition. Analysis of the demographic information including residence, level of education, and occupational status disclosed no significant relationship with the nutritional status (Table 2).

DISCUSSION

Malnutrition is an underestimated and frequent multifactorial disorder in the patients with cancer, which could occur in any stages of disease[8] and if left untreated, it can detrimentally influence the disease prognosis, increase the treatment-related adverse events and reduce the survival rate.

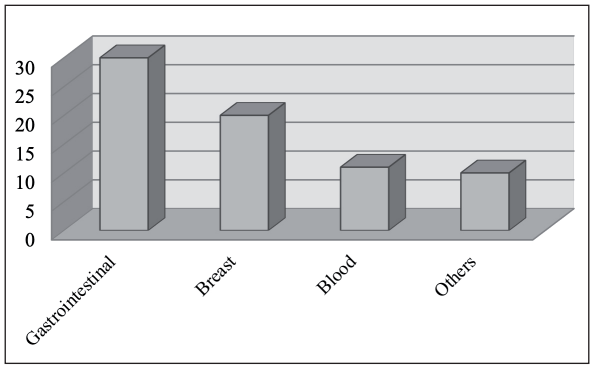

Fig. 1. Frequency of cancer type in participants.

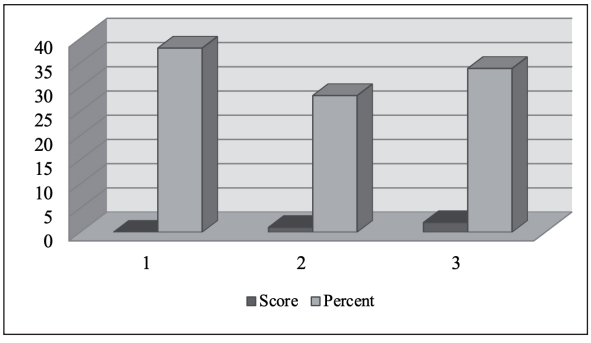

Fig. 2. Frequency of malnutrition risk in patients.

TABLE 2. Malnutrition risk, according to age, gender, cancer type and cancer stage.

Variable	Category	Malnutrition Risk			p-value
		Low	Moderate	High	
Age	18-65	24 (33.80)	15 (21.13)	14 (19.72)	0.043*
	>65	3 (4.22)	5 (7.04)	10 (14.1)	
Habitat	Urban	14 (19.72)	16 (22.53)	11 (15.5)	0.060*
	Rural	13 (18.31)	4 (5.63)	13 (18.31)	
Education	Illiterate	11(15.5)	9 (12.68)	15 (21.13)	0.685§
	<Diploma	8 (11.27)	3 (4.22)	5 (7.04)	
	Diploma	3 (4.22)	4 (5.63)	1 (1.41)	
	Academic educational	5 (7.04)	4 (5.63)	3 (4.22)	
Occupational status	Unemployed	0	2 (2.82)	2 (2.82)	0.668§
	Householder	14 (19.72)	9 (12.68)	7 (9.86)	
	Workingman	6 (8.45)	3 (4.22)	6 (8.45)	
	Self-employment	3 (4.22)	1 (1.41)	3 (4.22)	
	Employee	2 (2.82)	1 (1.41)	3 (4.22)	
	Retired	2 (2.82)	4 (5.63)	3 (4.22)	
Gender	Female	16 (22.53)	11 (15.50)	6 (8.45)	0.033*
	Male	11 (15.50)	9 (12.70)	18 (25.35)	
Cancer type	Gastrointestinal	6 (8.45)	9 (12.70)	15 (21.13)	0.008§
	Breast	12 (16.90)	7 (9.86)	1 (1.41)	
	Blood	5 (7.04)	3 (4.22)	3 (4.22)	
	Others	4 (5.63)	1 (1.41)	5 (7.04)	
Cancer stage	I	3 (4.22)	1 (1.41)	2 (2.82)	0.699§
	II	7 (9.86)	4 (5.63)	5 (7.04)	
	III	9 (12.70)	9 (12.70)	10 (14.1)	
	IV	6 (8.45)	6 (8.45)	9 (12.70)	

*Chi-square test
§ Fisher's Exact Test

Nutrition screening is a required task to detect the at-risk patients for undernutrition and to provide the information for the most effective type of intervention[18,19], including maintaining a healthy weight, adequate nutritional intake and choosing appropriate nutritional support methods[4,20]. For this purpose, the MUST questionnaire identifying the patients who are malnourished or at risk of malnutrition based on the association between the defective nutritional status, BMI, and physical function. This instrument can be used by any well-trained healthcare professional[16]. In this cross-sectional study, 53.5% of the studied subjects were male and 46.5% of them were female, with the mean BMI of 24.80 ± 5.32 kg/m^2. The gastrointestinal cancer was the most prevalent type of cancer followed by the breast and blood cancers. As stated by the Global Cancer Observatory (GLOBOCAN) statistics, stomach cancer in males and breast cancer in females are the most frequently diagnosed cancers in Iran[3]. According to the MUST scores, 62% of the patients had medium to high risk of malnutrition. But, in the previous studies, the malnutrition risk has been reported between 13.6-78.3% according to the different screening methods[5-8,13-15,21-28]. Loh et al[29] elucidated that three out of four patients with cancer undergoing the surgery experienced a degree of malnutrition. The high prevalence of malnutrition observed in our study is partly due to the fact that all the studied population was undergoing the chemotherapy, which itself may reduce the colorific intake[28]. In agreement with the studies conducted by Sarvariyan et al[23] and Qureshi et al[25], in our study, no significant relationship was found between the residence, level of education, and occupational status with the nutritional status. More recent evidence proposes that lower socioeconomic status is associated with higher mortality across race and ethnicity. It has been estimated that 34% of cancer-related death in America could be prevented through elimination of the socioeconomic gaps and cancer-related deaths were nearly 20% higher among the inhabitants of the poorest countries mainly due to the differences in exposure to the risk factors[1]. Totally, 48.65% of men and 18.8% of women were at high risk for malnutrition, which was statistically significant (p =0.043). This sex difference may be explained partly by the results of this study, which indicated that 80% of the gastrointestinal tumors happened in the male patients. Moreover, mortality rate of the cancers was reported to be higher in men, mainly due to

the molecular and genetic discrepancies between males and females[30]. Evidence also suggests that the male patients with cancer have higher depression scores, which may unfavorably affect nutritional status[31]. A number of researchers have concluded the controversial findings and found no significant relationship between the gender and nutritional disorders[6,7,23]. In line with our results, Zhu et al[8] manifested a significant relationship between the patient-generated subjective global assessment (PG-SGA) and nutrition risk screening 2000 (NRS2002) scores with the gender (p <0.01) and age (p <0.05). Zarifyeganeh et al[21] showed that the rate of cancer death was higher in men (31.7%) than women (26.7%). In a different manner, female sex as a factor has been reported to be significantly associated with the malnutrition (p <0.0001)[32]. A significant relationship was also detected between the age and malnutrition risk (p =0.033) so that, 55.5% of the patients aged over 65 years old and 26.4% of the patients aged 18-65years old had a high risk of malnutrition. In a multicenter study carried out by the National Cancer Institute (INCA), and the Brazilian Survey of Inquiry Oncology Nutrition (IBNO), an age ≥ 65 years old was considered as a potent risk factor for malnutrition in the patients with cancer[13]. On the contrary, *Sarvariyan et al*[23] demonstrated that the patients aged ≤ 65 years old were more likely to be at risk of malnutrition (p <0.02). Sanz et al[6] and Loh et al[29] found no significant difference in this regard. Several metabolic and physiological changes could occur as people getting older including loss of appetite, dry mouth, and late decay of tissues and organs. Changes in the body composition, resulting in a decrease in the muscle mass and an increase in the fat mass, may lessen the muscle strength and physical activity. This aging-related changes might have some adverse effects on the nutritional status[32,33]. The highest and lowest undernutrition risk belonged to the patients with gastrointestinal and breast cancers, respectively. Similarly, in the studies conducted in Italy and Iran, the highest frequency of malnutrition was observed in the presence of gastroesophageal and pancreatic tumors and undernutrition was less probable in the patients with breast cancer[5,7,23]. Sanz et al[6] concluded that approximately 100% of the patients with gastroesophageal tumors experienced weight loss in the last three months. Borges et al[27] also reported that the tumors of the digestive system showed higher nutritional risk based on the MUST (p =0.01) and SGA (p <0.0001) scores. Patients with digestive tract cancer are 23 times more likely to be at nutritional risk in comparison with other cancer sites, substantially due to the catabolic biology of disease, impaired food intake, absorption of the nutrients and digestion along with interruption in the intestinal passage, etc.[27,34,35]. Our study has some limitations including small sample size and short duration due to the special condition, so it is strongly recommended to conduct more studies with longer duration and larger sample size.

CONCLUSIONS

Failure to timely diagnose the cancer-related malnutrition and applying the appropriate nutritional intervention strategies along with anti-cancer therapies may exacerbate the appetite suppression, weight loss, muscular strength, increased susceptibility to the infections, and risk of pressure sores. Therefore, it is important to quickly detect the people with malnutrition or at risk of malnutrition by increasing the healthcare professional's awareness and implementing the suitable nutritional screening programs at the beginning and during the treatment process.

Funding:
No financial interest

Informed consent:
Informed written consent was obtained from all the patients

Conflict of interest:
The authors have disclosed that they have no significant relationships with, or financial interest in, any commercial companies pertaining to this article.

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