



Nutritional Assessment of Cancer Patients during Chemotherapy in Vasei Hospital of Sabzevar, Iran

Tahereh Tofighyan; MSc¹ & Akram Kooshki; PhD^{*2}

¹ Department of Nursing, School of Nursing and Midwifery, Sabzevar University of Medical Sciences, Sabzevar, Iran.

² Department of Nutrition & Biochemistry, School of Medicine, Sabzevar University of Medical Sciences, Sabzevar, Iran.

ARTICLE INFO

ORIGINAL ARTICLE

Article history:

Received: 28 Apr 2020

Revised: 23 Aug 2020

Accepted: 23 Aug 2020

*Corresponding author:

kooshki.nutr@gmail.com
Department of Nutrition & Biochemistry, School of Medicine, Sabzevar University of Medical Sciences, Sabzevar, Iran.

Postal code: 9616683481

Tel: +989159701470

ABSTRACT

Background: Malnutrition caused by cancer is a prevalent problem in patients with cancer. This study aimed to evaluate the nutritional status of cancer patients undergoing chemotherapy who referred to Vasei Hospital, Sabzevar, Iran. **Methods:** This descriptive-sectional study was conducted on 124 adult patients (older than 18 years of age) with cancer who had referred to the Oncology Ward of Vasei Hospital, Sabzevar, Iran. Followed by obtaining a consent letter and filling out the demographic questionnaire, the participants' height and weight were measured in minimum clothing without shoes based on the standard method. Later, the nutrient intake data were collected using the 2-day food intake record at the beginning and end of the chemotherapy. Nutrition IV Software was applied to evaluate the received nutrients. **Results:** In this research, the mean body mass index of patients was lower at the end than the beginning of chemotherapy ($P = 0.001$). Mean of serum albumin and total protein were normal at the beginning of the study, which was significantly reduced at the end of study ($P = 0.01$ and 0.01). Mean of energy, macronutrients, and micronutrients intake indicated a significant reduction from the beginning to the end of treatment ($P < 0.05$). **Conclusion:** Findings of this study showed that the mean of serum albumin, total protein and energy, macronutrients, and micronutrients intake indicated a significant reduction from the beginning to the end of treatment in this research.

Keywords: Cancer; Chemotherapy; Energy; Nutrients

Introduction

Cancer malnutrition is one of the most common problems among the cancer patients (Bozzetti, 2015, Bretón *et al.*, 2018). According to the conducted studies, widespread malnutrition caused by cancer was estimated about 30-90% based on the type, location, stage, and grade of the tumor, involved organs, type of anticancer therapies, patient's individual characteristics (age, gender), as

well as sensitivity and specificity of the parameters used to evaluate the nutritional status (Pouliat *et al.*, 2017, Sadeghi *et al.*, 2018, Watson *et al.*, 2018). Global statistics show that about 24.6 million people live with this disease and its side effects and almost 2 million people die annually due to cachexia complications of cancer (Schmidt *et al.*, 2018, Tarricone *et al.*, 2016). Cancer is the third

factor of mortality in Iran and more than 30,000 people suffer from this cancer die annually. It is estimated that more than 70,000 new cancer cases occur annually in Iran (Zarif yeganeh *et al.*, 2009). This multifactorial disease occurs followed by systematic and metabolic disorders caused by the host tumor and metabolism. Furthermore, its complications resulted in anticancer therapies, surgery, chemotherapy, radiotherapy, and bone marrow transplantation including dysphagia, dry mouth, anorexia, microsites, nausea, vomiting, diarrhea or constipation, and altered sense of taste leading to incomplete nutrients' intake, impaired digestion, nutrient intake, as well as cell deficiency of the micronutrients and macronutrients in patients (Arends *et al.*, 2017, Gorenc *et al.*, 2015, Sanz *et al.*, 2019). In this regard, intensified loss of appetite, weight loss, muscular atrophy, impaired immune response, increased risk of infections and bedsores, reduction in response to anti-cancer therapy and increased side effects, reduced functional capacity, depression, fatigue, and reduced quality of life are observed in case of undiagnosed malnutrition caused by cancer and lack of suitable nutritional support besides anticancer treatment (Caillet *et al.*, 2017, Goéré and Cunha, 2015). This kind of long-term and untreated malnutrition leads to cachexia caused by cancer reducing survival chance and increasing mortality rate in patients (Argiles, 2005, Eglseer *et al.*, 2017, Gorenc *et al.*, 2015).

Moreover, diet and nutrition may be considered as one of the important factors in prevention or treatment of various cancers. A large number of studies indicated that suitable dietary patterns may prevent from this cancer or inhibit development of tumor in patients. These compounds can be used as suitable options for cancer chemoprevention and cancer therapy via targeting a sequence of cellular and molecular pathways. Recently, dietary microRNAs and exosomes have emerged as attractive players in cancer prevention and cancer therapy. These molecules could change the behavior of cancer cells via targeting various cellular and molecular pathways involved in cancer pathogenesis. Hence, utilization of dietary

compounds associated with powerful molecules such as microRNAs and exosomes as well as their inclusion in the dietary patterns can contribute to the prevention or treatment of various cancers (Banikazemi *et al.*, 2018).

Based on the mentioned points, no adequate information is available about the patients' cancer status and malnutrition status during the chemotherapy in Iran (Khoshnevis *et al.*, 2012, Malihi *et al.*, 2013). Hence, this study aimed to evaluate the nutritional status of cancer patients undergoing chemotherapy referring to Vasei Hospital, Sabzevar, Iran.

Materials and Methods

Design and participants: This descriptive cross-sectional study was conducted on 124 adult patients (older than 18 years) with cancer who referred to the oncology ward of Vasei Hospital, Sabzevar, Iran. Simple nonprobability sampling was undertaken to select the sample size among cancer patients under chemotherapy who referred to Vasei Hospital, Sabzevar during October 2015- October 2016. Inclusion criteria included the patients' tendency for collaboration, while the exclusion criteria were suffering from diseases inducing cachexia such as cardiovascular diseases, pulmonary diseases, AIDS, liver and kidney failure, acute leukemia and multiple myeloma, and incomplete chemotherapy period prescribed by chemotherapist.

Measurements: Followed by obtaining the consent forms and filling out the demographic questionnaire, the participants' height and weight were measured with in minimum clothes without shoes based on the standard methods. Later, the nutrient intake data were gathered using a 2-day food intake record. Food frequency questionnaire is a standard questionnaire used in similar studies and had confirmed its validity and reliability (Hosseini Esfahani and Asghari, 2010). The collected data regarding the food intake amounts were converted to gram based on the domestic scales. Later, the data were entered into Nutrition IV Software to evaluate the received nutrients. It should be noted that food intake measurement was done by a trained and skilled nurse working in

chemotherapy unit in order to remove any possible errors. In addition, serum albumin and total protein amounts were recorded based on the patients' profiles. In this sense, serum albumin concentration from 3.5 to 5.5 g/dl was considered as normal case and serum albumin concentration of lower than 3.5 g/dl was considered as malnutrition. Serum total protein of 6-8 g/dl was considered as normal case and the one lower than 6 g/dl was considered as malnutrition. Furthermore, we recorded any supplements consumed by participants.

It is also worth reminding that the above-mentioned evaluations were performed for each patient within the two-time intervals at the beginning and end of chemotherapy in order to evaluate the patients' nutrition status.

Ethical considerations: Before implementing the research plan, relevant permissions were obtained from hospital officials and informed consent forms were completed by patients; in the case of unwillingness, the respondent could inform the researcher and withdrew from the research without any limitation.

Data analysis: The collected data were inserted into SPSS-17 Software and compared with the standard DRI (Dietary References Intakes) values using one sample and paired sample t-tests. The

significant level of 0.05 was considered for all analyses.

Results

This study was carried out on 135 cancer patients older than 18 years of age. Of these patients, 124 patients completed the treatment period and 9 respondents died during the study; meanwhile, the mortality rate among men was higher than women (67% compared to 33%). In this study, lung cancer had the highest frequency, while bone marrow cancer had the lowest frequency (32% vs 7%). In the case of tumor type, the most common cause of death was lung cancer in men and genital cancer in women. Of 124 patients, 58 patients (46.8%) were men and 66 patients (53.2%) were women. The mean age of studied patients was 54.6 ± 15.3 years. Patients' weight mean and BMI related to the beginning and end of study are indicated in **Table 1**.

Serum albumin and total protein of patients were reduced at the end of the study ($P = 0.01$, **Table 1**). Moreover, energy and macronutrients intake, except protein, was not significantly different from the beginning to end of treatment in this study (**Table 2**). Micronutrients intake indicated a significant reduction from the beginning to the end of treatment in this study (**Table 2**).

Table 1. Mean \pm SD of weight and body mass index, serum albumin and total protein of patients at the beginning and end of the study

Variables	First of study	End of study	P-value ^a
Weight (kg)	62.48 \pm 13.43	56.54 \pm 16.0	0.001
Body mass index (kg/m ²)	23.45 \pm 3.45	20.21 \pm 2.33	0.001
Serum albumin (g/dl)	4.2 \pm 0.5	3.4 \pm 0.6	0.01
Serum total protein (g/dl)	6.8 \pm 0.3	5.5 \pm 0.2	0.01

^a: Student t-test.

Table 2. Mean \pm SD of energy, macronutrients and micronutrients intake of patients at the beginning and end of the study

Variables	First of study	End of study	P-value ^a
Energy (kcal/d)	1770 \pm 171	1638 \pm 820	0.11
Carbohydrate (g/d)	210 \pm 113	188 \pm 104	0.16
Protein (g/d)	73.9 \pm 44.0	68.0 \pm 44.0	0.0001
Fat (g/d)	76.0 \pm 42.8	74.0 \pm 45.0	0.08
Cholesterol (mg/d)	341 \pm 295	319 \pm 281	0.5

Table 2. Mean \pm SD of energy, macronutrients and micronutrients intake of patients at the beginning and end of the study

Variables	First of study	End of study	P-value ^a
Vitamin A(mcg/d)	1423 \pm 1328	1257 \pm 1174	0.0001
Vitamin D(mcg/d)	1.12 \pm 2.11	0.53 \pm 0.95	0.0001
Vitamin E(mg/d)	2.73 \pm 1.30	2.50 \pm 1.15	0.0001
Vitamin K(mcg/d)	67.13 \pm 87.00	60.00 \pm 45.00	0.0001
Vitamin B1(mg/d)	1.40 \pm 0.65	1.20 \pm 0.58	0.03
Vitamin B2(mg/d)	2.07 \pm 1.60	1.98 \pm 1.70	0.03
Vitamin B3(mg/d)	20.00 \pm 15.00	16.35 \pm 9.00	0.05
Vitamin B6(mg/d)	1.30 \pm 0.70	1.20 \pm 0.65	0.05
Folate (mcg/d)	223 \pm 119	202 \pm 119	0.0001
Vitamin B12(mcg/d)	4.4.00 \pm 2.05	3.70 \pm 2.10	0.0001
Vitamin C(mg/d)	147 \pm 121	183 \pm 159	0.0001
Calcium(mg/d)	755 \pm 373	718 \pm 431	0.0001
Phosphor(mg/d)	1046 \pm 667	1044 \pm 625	0.0001
Magnesium(mg/d)	247 \pm 123	237 \pm 130	0.0001
Sodium(mg/d)	1168 \pm 878	1130 \pm 905	0.0001
Potassium(mg/d)	3190 \pm 2183	2892 \pm 2078	0.01
Iron(mg/d)	19.6 \pm 6.2	12.2 \pm 9.3	0.83
Zinc(mg/d)	9.75 \pm 5.20	8.9 \pm 5.2	0.16
Selenium(mcg/d)	10.17 \pm 0.80	0.9 \pm 0.6	0.0001

^a: Student *t*-test.

Discussion

As it was mentioned, malnutrition caused by cancer is a multifactorial complication that can lead to cachexia and increase the mortality rate if it is ignored. Lin et al. showed that after chemotherapy, 52.9% of the patients were considered moderately malnourished; whereas, 33.8% were severely malnourished (Lin *et al.*, 2020). The nutritional status had deteriorated in the majority of patients. After chemotherapy, a rise was found in the prevalence of nutrition impact symptoms (Lin *et al.*, 2020).

In this research, the average BMI of patients was lower at the end of therapy than the beginning of course and this result was statistically significant. Patricia reported that cancer patients were at risk for sustained malnutrition beyond the treatment completion (Wilkes and Allen, 2018). A significant reduction was observed in BMI of individuals in the study conducted by Zarif et al., which is in the same line with the results obtained by the present study (Zarif yeganeh *et al.*, 2009). Mahdavi et al. reported that weight loss was

observed in patients under treatment (Mahdavi *et al.*, 2001).

Weight loss and BMI of cancer patients under the chemotherapy treatment were among the most effective factors in their mortality. Weight loss in patients undergoing chemotherapy may be associated with the side effects of chemotherapy medicines that intensify anorexia, nausea, vomiting, and other gastrointestinal symptoms reducing nutrients intake rate. Moreover, weight loss and nutritional complaints are usually attributed to cancer; as a result, the patients, their family members, and therapists do not address the patient's problems in this case. Therefore, it is essential to design nutritional interventions for such patients (Khoshnevis *et al.*, 2012).

In this research, the average serum albumin and total protein were normal at the beginning of the study but significantly reduced at the end of therapy. Considering the normal level of serum albumin and total protein (serum albumin concentration of 3.5-5.5 g/dl is normal and lower than 3.5 g/dl shows malnutrition; serum total protein of 6-8 g/dl is normal and lower than 6 g/dl

indicates malnutrition), patients suffered from malnutrition at the end of study. Chao et al. conducted a study to examine the nutritional status of cancer patients and indicated that the serum albumin average was 2.7 g/dl after chemotherapy that is almost similar to serum albumin obtained in our study (Chao and Lin, 2017). Zarif et al. reported that the total protein rate was at the normal level prior to the therapy and lower than the normal level during the treatment period (Zarif yeganeh *et al.*, 2009). This finding was in line with the results obtained in this paper. Our findings are also in the same line with the results obtained from the studies conducted by the others who reported increased malnutrition rate in cancer patients (Laviano *et al.*, 2011, Näppä *et al.*, 2016, Nasrah *et al.*, 2018). Therefore, cancer patients may suffer from malnutrition during their illness and treatment periods (Bozzetti, 2013).

In addition, energy and macronutrients intake, except protein, was not significant from the beginning to the end of treatment in this study. Micronutrients' intake indicated a significant reduction from the beginning to the end of treatment in this study. Zarif and Faramarzi reported a significant reduction in the energy and protein consumption average in cancer patients during the treatment period (Faramarzi *et al.*, 2001, Zarif yeganeh *et al.*, 2009). Considering the side effects of chemotherapy medicines including nausea, vomiting, appetite loss, taste changes, dryness, and inflammation of the tongue, food intake and energy consumption will be reduced during the treatment period. In other words, these complications make some enjoyable foods for patient prior to the therapy as undesirable foods leading to reduced food intake and intensified malnutrition (Mansour *et al.*, 2018, Marshall *et al.*, 2019).

Norat et al. noted that the association between diet and cancer is complex (Norat *et al.*, 2015). Thousands of dietary components are consumed each day, so that a typical diet may provide more than 25,000 bioactive food constituents. Each bioactive food constituent has the potential to

modify multiple aspects of the cancer process, (individually or in combination with several micronutrients) quantity, timing, and duration of exposure modulate the cell response. Thus, it is not possible to ascribe a causal effect to specific compounds; it is more likely that this effect results from a combination of influences on several pathways involved in carcinogenesis. A growing body of evidence indicates that lowering the energy density (the amount of energy in a particular weight of food) of diets can reduce the caloric intake. Energy dense diets contain less fiber -rich foods and are usually high in fats, processed starch, and added sugar. Furthermore, experimental studies show that calcium salts, chlorophyll, vitamin C, and several polyphenols may reduce cancer rate (Norat *et al.*, 2015). In this regard, large cohort studies suggest that dietary pattern has a substantial impact on the risk of developing various malignancies. In the United States, a vast majority of Americans consume the Western diet consisting of a high intake of fats, processed meat, dairy, and carbohydrates, but low intakes of fiber. This composition was associated with broadly negative impacts on glycemic load, fatty acid composition, micronutrient and macronutrient composition, sodium intake, and fiber content; all of these items can contribute to tumorigenesis (Gray *et al.*, 2020).

Schwingshack reported that the Mediterranean diet gained attention as a healthy diet to reduce the risk of cancer. This diet is defined by high consumption of plant-based foods, whole grain products, vegetables, fruits, nuts, and legumes along with a regular intake of fish and seafood, and limited amounts of eggs and red/processed meats (Schwingshackl and Hoffmann, 2015).

Although energy consumption did not reduce significantly, weight loss occurred. This discrepancy seems to be due to an over-reporting error in patients' energy and macronutrient intake.

The study has a limitation: lack of cooperation of some patients due to their unfavorable condition. However, further well-planned studies in clinical settings may be needed to assess the

effects of nutrients on chemotherapy in cancer patients.

Conclusion

Findings of this study showed that the mean of serum albumin, total protein and energy, macronutrients, and micronutrients intake indicated a significant reduction from the beginning to the end of treatment in this research.

Acknowledgements

This study was supported by Sabzevar University of Medical Sciences, Iran. The authors appreciate the staff of chemotherapy section of Vasei hospital for their valuable assistance and also we acknowledge the cooperation of the participating patients.

Authors' contributions

Both authors were equally involved in conducting the research project and writing the manuscript.

Conflict of Interest

The authors have no conflict of interests to declare.

References

- Arends J, et al.** 2017. ESPEN expert group recommendations for action against cancer-related malnutrition. *Clinical Nutrition*. **36** (5): 1187-1196.
- Argiles J** 2005. Cancer-associated malnutrition. *European Journal of Oncology Nursing*. **9**: S39-S50.
- Banikazemi Z, et al.** 2018. Diet and cancer prevention: Dietary compounds, dietary MicroRNAs, and dietary exosomes. *Journal of Cellular Biochemistry*. **119** (1): 185-196.
- Bozzetti F** 2013. Nutritional support of the oncology patient. *Critical Reviews in Oncology, Hematology*. **87** (2): 172-200.
- Bozzetti F** 2015. Evidence-based nutritional support of the elderly cancer patient *Nutrition*. **31** (4): 585-586.
- Bretón M, et al.** 2018. Nutritional support and parenteral nutrition in cancer patients: An expert consensus report. *Endocrinología, Diabetes y Nutrición (English ed.)*. **65**: 17-23.
- Caillet P, et al.** 2017. Association between cachexia, chemotherapy and outcomes in older cancer patients: a systematic review. *Clinical Nutrition*. **36** (6): 1473-1482.
- Chao P & Lin C** 2017. Successful early elemental diet nutritional support in an esophageal cancer patient. *Journal of Cancer Research and Practice*. **4**, (2): 66-71.
- Eglseer D, Halfens R & Lohrmann C** 2017. Is the presence of a validated malnutrition screening tool associated with better nutritional care in hospitalized patients? *Nutrition*. **37**: 104-111.
- Faramarzi A, Mahdavi R, Mohammadzadeh M, Ghaem Maghami S & Vahed Jabbari M** 2001. Nutrition status of cancer patients treated with radiotherapy. In *9th Iranian Nutrition Congress, Tabriz*, p. 84 [in persian].
- Goéré D & Cunha A** 2015. Parenteral and enteral nutritional support (excluding immunonutrition). *Journal of Visceral Surgery*. **152**: S8-S13.
- Gorenc M, Kozjek N & Strojan P** 2015. Malnutrition and cachexia in patients with head and neck cancer treated with (chemo) radiotherapy. *Reports of Practical Oncology & Radiotherapy*. **20** (4): 249-258.
- Gray A, Dang B, Moore T, Clemens R & Pressman P** 2020. A review of nutrition and dietary interventions in oncology. *SAGE Open Medicine*. **8**: 2050312120926877.
- Hosseini Esfahani F & Asghari G** 2010. Validity and reliability of food groups intake by frequency of food frequency questionnaire: Tehran sugar and Lipid Study. *Journal of Iran University of Medical Sciences*. **17** (71): 41-55 [in persian].
- Khoshnevis N, Shaheed Sales S, Alizadeh M, Mir Sadraee M & Akbari M** 2012. Evaluation of Nutrition Status by PG-SGA in Cancer Patients at Cancer Research Center of Shahid Beheshti University of Medical Sciences in 2010. *Journal of Research in Medicine*. **36** (3): 132-138 [in persian].

- Laviano A, et al.** 2011. Beyond anorexia-cachexia. Nutrition and modulation of cancer patients' metabolism: Supplementary, complementary or alternative anti-neoplastic therapy? *European Journal of Pharmacology*. **668**: S87-S90.
- Lin T, et al.** 2020. Nutritional status in patients with advanced lung cancer undergoing chemotherapy: a prospective observational study. *Nutrition and Cancer*. **72 (7)**: 1225-1230.
- Mahdavi R, Faramarzi A, Mohammadzadeh M & Ghaem Maghami S** 2001. Evaluation and comparison of nutritional status of cancer patients before and after treatment with radiotherapy. *Journal of Tabriz University of Medical Sciences*. **28 (3)**: 107-112 [in persian].
- Malihi Z, et al.** 2013. Nutritional status and quality of life in patients with acute leukaemia prior to and after induction chemotherapy in three hospitals in Tehran, Iran: a prospective study. *Journal of Human Nutrition and Dietetics*. **26**: 123-131.
- Mansour F, et al.** 2018. Malnutrition in patients with breast cancer during treatments (Algeria, 2016). *Nutrition Clinique et Métabolisme*. **32 (2)**: 129-137.
- Marshall K, Loeliger J, Nolte L, Kelaart A & Kiss N** 2019. Prevalence of malnutrition and impact on clinical outcomes in cancer services: A comparison of two time points *Clinical Nutrition*. **38 (2)**: 644-651.
- Näppä U, Lindqvist O, Rasmussen B & Axelsson B** 2016. Routine assessment of performance status during palliative chemotherapy when approaching end-of-life. *European Journal of Oncology Nursing*. **21 (266-271)**.
- Nasrah R, et al.** 2018. Defining the role of dietary intake in determining weight change in patients with cancer cachexia. *Clinical Nutrition*. **37 (1)**: 235-241.
- Norat T, et al.** 2015. European code against cancer 4th edition: diet and cancer. *Cancer Epidemiology*. **39 (S56-S66)**.
- Pouliou K, et al.** 2017. The two most popular malnutrition screening tools in the light of the new ESPEN consensus definition of the diagnostic criteria for malnutrition. *Clinical Nutrition*. **36 (4)**: 1130-1135.
- Sadeghi M, et al.** 2018. Cancer cachexia: diagnosis, assessment, and treatment. *Critical Reviews in Oncology/Hematology*. **127**: 91-104.
- Sanz E, et al.** 2019. Nutritional risk and malnutrition rates at diagnosis of cancer in patients treated in outpatient settings: early intervention protocol. *Nutrition*. **57**: 148-153.
- Schmidt S, Rohm M, Herzig S & Diaz M** 2018. Cancer Cachexia: More Than Skeletal Muscle Wasting. *Trends in Cancer*. **4 (12)**: 849-860.
- Schwingshackl L & Hoffmann G** 2015. Adherence to Mediterranean diet and risk of cancer: an updated systematic review and meta-analysis of observational studies. *Cancer Medicine*. **4 (12)**: 1933-1947.
- Tarricone R, Ricca G, Nyanzi-Wakholi B & Medina-Lara A** 2016. Impact of cancer anorexia-cachexia syndrome on health-related quality of life and resource utilisation: A systematic review. *Critical Reviews in Oncology/Hematology*. **99**: Pages 49-62.
- Watson R, Singh R & Takahashi T** 2018. The Role of Functional Food Security in Global Health. Academic Press.
- Wilkes P & Allen D** 2018. Nutrition Care: Managing Symptoms From Cancer. *Journal for Nurse Practitioners*. **14 (4)**: 267-275.
- Zarif yeganeh M, et al.** 2009. Evaluation of nutritional status of cancer patients during chemotherapy in hospitals affiliated to Iran University of Medical. *Journal of Iran University of Medical Sciences* **16 (65)**: 3-25 [in persian].