

ORIGINAL ARTICLE

## Prevalence of Malnutrition in Patients with Head and Neck Cancer in Yazd, Iran

Mohammad Hossein Dadgarnia<sup>1</sup>, Mohammad Hossein Baradaranfar<sup>1</sup>, Mohammad Shirkhoda<sup>2</sup>, Sedighe Vaziribozorg<sup>1</sup>, Shima Shirkhoda<sup>1\*</sup>

1. Department of Otolaryngology- Head and Neck Surgery, Otorhinolaryngology Research Center, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

2. Department of Oncosurgery, Cancer Institute of Iran, Tehran University of Medical Sciences, Tehran, Iran

### ARTICLE INFO

*Keywords:*

Head  
Neck  
Cancer  
Malnutrition  
Iran

*\*Corresponding author:*

Shima Shirkhoda,  
Department of Otolaryngology-  
Head and Neck Surgery,  
Otorhinolaryngology Research  
Center, Shahid Sadoughi University  
of Medical Sciences,  
Yazd, Iran.

**Tel:** +98-353-8224000

**Fax:** +98-353-8224100

**Email:** [shimashirkhoda2017@gmail.com](mailto:shimashirkhoda2017@gmail.com)

**Received:** January 6, 2018

**Revised:** December 29, 2018

**Accepted:** January 12, 2019

### ABSTRACT

**Background:** Head and neck cancers are accounted for 4.9% of all cancers worldwide. The aim of this study was to evaluate the prevalence of malnutrition in patients with head and neck cancers in Yazd, Iran.

**Methods:** Eighty-nine patients with locally advanced head and neck cancers who referred to a training clinic or a hospital were included in this cross sectional study. All patients were assessed for nutritional status by Patient Generated Subjective Global Assessment (PG-SGA) questionnaire, and serum albumin and hemoglobin levels.

**Results:** Bases on PG-SGA assessment, 49.4% of the patients had proper nutrition, 30.4% were at risk or suspected to malnutrition, and 20.2% had severe malnutrition. The prevalence of malnutrition was significantly related to gender of patients, type of treatment and the stage of the disease. There was no significant relationship between the prevalence of malnutrition and age, although the prevalence of severe malnutrition was higher at older ages.

**Conclusion:** The prevalence of malnutrition among our patients was high. Nutritional evaluation is very important to detect patients at risk of malnutrition or with malnutrition and helps to choose the nutritional treatment.

Please cite this article as: Dadgarnia MH, Baradaranfar MH, Shirkhoda M, Vaziribozorg S, Shirkhoda S. Prevalence of Malnutrition in Patients with Head and Neck Cancer in Yazd, Iran. Int J Nutr Sci 2019;4(1):23-29. doi: 10.30476/IJNS.2019.81441.1006.

### Introduction

Cancer is as a major health problem worldwide and is the third leading cause of death in Iran (1, 2). Head and neck cancers (HNCs) are defined as malignant tumors of the airways and upper digestive system, and known as the sixth common world cancers (3). The anatomical areas involved are the oral cavity, nose, nasopharynx, oropharynx, hypopharynx, larynx, thyroid, and salivary glands (4). HNCs are accounted for the annual incidence of 690,000 cases (4.9% of incidence of all cancers)

and almost 375,000 global deaths (4.6 of all deaths from cancers) in 2012 (5). In Iran, Mirzaei et al., showed that all types of HNCs were 46.3 cases per 100,000 people (49.5 in men and 43 in women, respectively) (3).

These findings indicated a high level of HNCs in the country, similar to other studies in the world (6). The relationship between cancer and malnutrition has been established for a long time. Malnutrition can occur at all stages of the disease. The overall prevalence of malnutrition, regardless of cancer

type, is about 40% and has remained constant for the last 30 years. The percentage of malnourished patients is particularly high among patients with gastrointestinal or HNCs (7). The etiology of malnutrition is multifactorial and its mechanisms are complex (8-10).

Prevention and early management by appropriate nutritional support limit the extent of malnutrition and correction of malnutrition decreases the number of outpatient visits and hospital admissions, facilitates therapeutic management and limits treatment-related complications (11). The prevalence of malnutrition in patients with HNCs has been reported about 50% in Prevost et al.'s study. The objective of this study was to assess the nutritional status based on clinical and laboratory data in patients with HNCs and therefore, to study the prevalence of malnutrition in this population (12).

### Materials and Methods

After approval by the local Ethics Committee and obtaining written informed consent, all patients with locally advanced HNCs who referred to a training clinic or a hospital (Shahid Sadoughi Hospital, affiliated to Shahid Sadoughi University of Medical Sciences, Yazd, Iran) between 2016 and 2017 were enrolled in this cross-sectional study. Patients with diabetes, hepatic or renal failure, alcohol dependence, heart failure, immune system disorders, aplastic anemia and previous surgical or oncological treatments were excluded. Demographic data of patients, swallowing disorders and their type of treatment (Surgery or Chemotherapy) were recorded. The location of the tumor was also examined by clinical examination and radiological findings, and the stages of tumors was determined by a pathologist.

After clinical examination and complete history taking, all patients were evaluated for nutritional status by Patient Generated Subjective Global Assessment (PG-SGA) questionnaire (13) and serum albumin (BROMOCRESOL GREEN in acid PH created a green-blue colored complex, while the intensity of the created color was proportional to the amount of albumin in the sample) and hemoglobin level (calculated by light absorbance of the sample at 540 nm with optical absorption and standard concentration, or with the aid of a standard curve) that were measured in the laboratory of Shahid Sadoughi Hospital in Yazd, Iran (Hb; normal value, 12.0-15.0 mg/dL; Alb; normal value, 3.5-5.5 mg/dL) were recorded.

The patient-generated-subjective global assessment (PGSGA) was adapted from the SGA and developed specifically for patients with cancer (14). It included additional questions regarding the presence of nutritional symptoms and short-term weight loss. In this study, PG-SGA was completed as described by Ottery (15). Each patient was classified as well-nourished (SGA A), moderately or suspected of being malnourished (SGA B) or severely malnourished (SGA C) based on Ottery questionnaires (Table 1). In addition, for a more complete evaluation of malnutrition in patients, the prognostic nutritional index (PNI) was calculated based on the formula provided by Pinato according to the serum albumin level and the number of lymphocytes (16).

The PNI was calculated as described previously where combined albumin $\times$ total lymphocyte counts $\geq$ 45, at presentation, were allocated a PNI score of 0.00. Patients in whom this total was  $<$ 45 were allocated a PNI score of 1, where a PNI of 1 was indicative of severe nutritional impairment and PNI of 0.00 was normal. Also, the Nutrition Risk

**Table 1:** PG-SGA Global Assessment Categories

Variable	Stage		
	A	B	C
Category	Well nourished	Moderately malnourished	Severely malnourished
Weight	No weight loss or recent weight gain	$\leq$ 5% weight loss in 1 month or 10% in 6 months OR Progressive weight loss	$>$ 5% weight loss in 1 month or $>$ 10% in 6 months or progressive weight loss
Nutritional intake	No deficit or significant recent improvement	Definite decrease in intake	Severe deficit intake
Nutritional impact	None or significant recent improvement allowing adequate intake	Present of nutrition impact	Present of nutrition impact
Symptoms	None	Any symptoms that patient reports	Any symptoms that patient reports
Functioning	No deficit or recent improvement	Moderate functional deficit	Severe functional deficit
Physical exam	No deficit	Evidence of mild to moderate loss of muscle mass	Obvious signs of malnutrition

**Table 2:** Characteristics and demographic data

Variable	No. (%)
Male	60 (67.4)
Female	29 (32.6)
Swallow problem	30 (33.7)
Without swallow problem	59 (66.3)
Surgery treatment	68 (76.4)
Chemotherapy treatment	21 (23.6)
With NG/PEG	4 (4.5)
Without NG/PEG	85 (95.5)
Mean age (range)	50.7 (14-90) years
Mean Hemoglobin level±SD at baseline	13.9±4.2 (mg/dL)
Mean Serum Albumin±SD at baseline	3.2±0.7 (mg/dL)

No: Number of patients; NG: Nasogastric Tube; PEG: Percutaneous endoscopic gastrostomy

Index (NRI) was calculated based on the study of V. Prevost (12). a NRI score higher than 100 was considered normal, 97.5 to 100 was regarded as mild malnutrition, 83.5 to 97.5 as malnutrition and less than 83.5 as severe malnutrition. For statistical analysis, SPSS software (version 21, Chicago, IL, USA) was used. The end point was used to investigate the prevalence of malnutrition. Also, the prevalence of malnutrition by gender, age, treatments, stage of tumor, serum albumin and Hb levels was compared with Chi-Square, Fisher or T-Student tests.  $P < 0.05$  was considered statistically significant.

## Results

The mean age of patients was  $50.7 \pm 15.2$  years (range: 14-90 years). Sixty (67.4%) patients were male and 29 (32.6%) were female. At baseline, the mean value of albumin was  $3.2 \pm 0.7$  mg/dL and mean hemoglobin level was  $13.9 \pm 4.2$  mg/dL. Totally, 33.7% of patients had swallowing disorders and 4.5% had nasogastric (NG) tube or PEG. A total of 76.4% of the patients underwent surgery and 23.6% of them were treated by chemotherapy or radiotherapy (Table 2). The most common locations of HNCs were salivary glands (28.1%), followed by glottic (23.6%) and oral cavity (13.5%) and most of the patients were at stage II (45, 50.6%) (Table 3).

The nutritional status was assessed with Ottery's PG-SGA. Bases on PG-SGA assessment, 49.4% of the patients had proper nutrition, 30.4% were at risk or suspected to malnutrition, and 20.2% had severe malnutrition. The prevalence of malnutrition was significantly correlated with gender of patients ( $P = 0.002$ ). Totally, 75.9% of women had proper nutritional status, while 36.7% of men had proper nutritional status. Severe malnutrition was noticed among 26.7% and 6.9% of men and women, respectively. Therefore, the prevalence of malnutrition in patients with HNCs was higher in men.

There was also a significant relationship between

**Table 3:** Tumor location and stage

Variable	No. (%)
Tumor locations	
Salivary Gland	25 (28.1)
Glottic	21 (23.6)
Oral cavity	12 (13.5)
Maxillary sinus	8 (9)
Supraglottic	7 (7.9)
Nasopharynx	6 (6.7)
Hypopharynx	4 (4.5)
Lip	3 (3.4)
Unknown	2 (2.2)
Oropharynx	1 (1.1)
Tumor stage	
I	3 (3.4)
II	45 (50.6)
III	30 (33.7)
IV	11 (12.4)

No: Number of patients

the prevalence of malnutrition and the type of treatment and the stage of the disease in patients with HNCs, but its prevalence did not have a significant correlation with the age, although the prevalence of severe malnutrition was higher at older ages. In patients in SGA-A and SGA-B groups, mean value of serum albumin was  $3.8 \pm 0.4$  and  $3 \pm 0.4$  mg/dL, respectively whereas, in patients in SGA-C group was  $2.4 \pm 0.5$  mg/dL ( $p = 0.001$ ). Mean hemoglobin level in well-nourished patients was  $14.6 \pm 5.6$  mg/dL, in moderately and severe malnourished patients was  $13.5 \pm 1.8$  and  $13.1 \pm 1.7$  mg/dL, respectively ( $p = 0.30$ ) (Table 4). The results of prognosis nutritional index (PNI) and nutritional risk index (NRI) were shown in Table 5.

## Discussion

The incidence of malnutrition among patients with cancer has been estimated between 40 and 80% (17, 18). The prevalence of malnutrition depends on the tumor type, location, stage and treatment (19).

**Table 4: Patient-Generated Subjective Global Assessment in cancer patients**

Variable	SGA A well-nourished	SGA B moderately malnourished	SGA C severely malnourished	P value
No. of patients (%)	44 (49.4)	27 (30.4)	18 (20.2)	-
Gender (M/F)	22:22	22:5	16:2	0.002*
Age (year)	48.5±14.6	49.4±15	57.9±16	0.070*
Treatment (S/C)	40:4	20:7	8:10	0.001*
With NG/Without NG	44:0	25:2	16:2	0.1*
Tumor Stage				0.001*
1	3 (100)	-	-	
2	34 (75.6)	10 (22.2)	1 (2.2)	
3	7 (23.3)	11 (36.7)	12 (40)	
4	-	6 (54.5)	5 (45.5)	
Mean serum albumin±SD (mg/dL)	3.8±0.4	3±0.4	2.4±0.5	0.001 <sup>+</sup>
Mean serum hemoglobin±SD (mg/dL)	14.6±5.6	13.5±1.8	13.1±1.7	0.3 <sup>+</sup>

M: Male, F: Female; S: Surgery; C: Chemotherapy; NG: Nasogastric tube; SD: Standard deviation. \*Chi-Square test, +Anova test

**Table 5: The results of prognosis nutritional index (PNI) and nutritional risk index (NRI)**

Variable	No. (%)
Nutritional risk index (NRI)	
Normal	36 (40.4)
Mild	6 (6.4)
Moderate	29 (32.6)
Severe	18 (20.2)
Prognostic nutritional index (PNI)	
Sever nutritional impairment	49 (55.1)
Normal	40 (44.9)
No.: Number of patients	

The consequences of malnutrition may include an increased risk of complications, decreased response and tolerance to treatment, a lower quality of life, reduced survival and higher health-care costs (9, 14, 20). The most common cancers associated with malnutrition were gastrointestinal cancers and HNCs (9). The prevalence of malnutrition in patients with HNCs was reported about 50% (7).

Without proper screening, more than half of the patients at risk or unknown malnutrition are not referred for treatment, and often weight loss in these patients is commonly accepted as a common consequence of cancer, while proper educational and therapeutic interventions can prevent its onset (21, 22). This study showed that the most common source of cancers in the head and neck was salivary glands, and the majority of patients (50.6%) were in stage 2 of the disease. The most common type of pathology among HNCs was squamous cell carcinoma (SCC) (46.1%). According to PG-SGA, 49.4% of patients had proper nutrition, 30.4% were at risk or suspected to malnutrition, and 20.2% of patients had severe malnutrition.

Thus, more than half of patients with HNCs (50.6%) were suspected to malnutrition or severe

malnutrition. The findings of the study showed that the prevalence of malnutrition in men was significantly higher than women, but its prevalence did not have a significant relationship with the age, although the prevalence of severe malnutrition was higher at older ages. Also, the prevalence of malnutrition in chemotherapy patients was higher than those who had undergone surgery. In addition, higher stage of disease was associated with a higher incidence of malnutrition. Khoshnevis et al. showed that the prevalence of moderate to severe malnutrition was 53.1% in the patients, which is consistent with the present study.

Of course, their study did not focus solely on HNCs, and all patients with gastrointestinal, breast, lung, genitourinary and other cancers were evaluated. In contrast to the present study, the prevalence of malnutrition in their study did not have a significant relationship with gender, although the prevalence of malnutrition was higher in males. Similar to the present study, the prevalence of malnutrition in patients undergoing chemotherapy and radiotherapy was more than patients undergoing surgical treatment (23). In another study at the University of Alberta in 2008, 350 patients with HNCs were evaluated, that

over 55% of the patients were at risk of malnutrition and 30% had severe malnutrition, which was higher than this study.

According to the present study, in their study, the prevalence of malnutrition in patients undergoing chemotherapy and radiotherapy was higher than patients undergoing surgery. They reported that nutritional support in these therapies should be considered because radiotherapy limited the oral intake of patients with HNCs (24). Mala et al. noted that in patients with HNCs who were supported by PEG and intestinal nutrition, there was less weight loss and less hospitalization than patients undergoing conservative treatment. It also denoted to an increase in the tolerance of the treatment and quality of life (25).

Planas et al. showed that 33.9% of cancer patients were at risk of severe malnutrition. The duration of hospitalization was also higher in these patients. In addition, at older ages, patients were more likely at risk of malnutrition (26). Another study by Lopez et al. Who examined the nutritional status of 997 cancer patients, PG-SGA showed a malnutrition prevalence of 72.9% (29.9% with moderate malnutrition and 43% with severe malnutrition), that was greater than the present study, and this difference was probably due to the difference in the number of samples and also the widespread type of cancer in the Lopez et al.'s study.

In contrast to the present study, the prevalence of malnutrition was not significantly correlated with the age and gender of the patients, but similar with the present study, the prevalence of malnutrition was significantly related to the stage of the disease and type of cancer (27). The study of Noroozi et al. on 166 cancer patients, based on the malnutrition universal screening tools (MUST) assessment method, showed that 12.6% of patients were moderately malnourished and 38.5% were severely malnourished. In contrast to the present study, in their study, there was no significant relationship between malnutrition and age, gender, occupation, educational level, marital status and type of treatment, but there was a significant relationship between malnutrition and type of cancer (28).

In another study in patients with gastrointestinal cancer, the nutritional status of the patients was assessed based on PG-SGA and NRI, which 70.6% and 74.5% of patients in accordance with these criteria were malnourished, respectively. In the present study based on NRI, 40.4% of patients had normal nutritional status, 6.4% had mild malnutrition, 32.6% had moderate and 20.2% had severe malnutrition (28). In a study by Faramarzi et al. in Tabriz, Iran, based on PG-SGA, 33% of

patients had moderate malnutrition and 19% had severe malnutrition, which is consistent with the present study. In their study, NRI results showed that 35% had moderate malnutrition and 10% had severe malnutrition (30). Therefore, the design of nutrition screening and counseling programs, along with the administration of supplements and micronutrients in cancer patients, is a necessity, along with the type of treatment and other clinical conditions, in the prognosis of illness, treatment, reducing the hospitalization time, increasing mobility, preventing depression, and ultimately improving the quality of life of patients are very effective.

### Conclusion

The prevalence of malnutrition among our patients was high. Nutritional evaluation is very important to detect patients at risk of malnutrition or with malnutrition and helps to choose the nutritional treatment.

### Acknowledgement

The current work was kindly supported by Shahid Sadoughi University of Medical Sciences.

### Conflict of Interest

None declared.

### References

- 1 Keyghobadi N, Rafiemanesh H, Mohammadian-Hafshejani A, et al. Epidemiology and trend of cancers in the province of Kerman: southeast of Iran. *Asian Pac J Cancer Prev*. 2015;16:1409-13. DOI:10.7314/apjcp.2015.16.4.1409. PMID:25743807.
- 2 Mehrabani D, Almasi A, Farahmand M, et al. Incidence of breast cancer in Fars Province, Southern Iran: A hospital-based study. *Word J Plast Surg*. 2012;1:16-21.
- 3 Mirzaei M, Hosseini SA, Ghoncheh M, et al. Epidemiology and trend of head and neck cancers in Iran. *Glob J Health Sci*. 2016;8:189-93. DOI:10.5539/gjhs.v8n1p189. PMID:26234980.
- 4 Krishnatreya M, Rahman T, Katak AC, et al. Pre-treatment performance status and stage at diagnosis in patients with head and neck cancers. *Asian Pac J Cancer Prev*. 2014;15:8479-82. DOI:10.7314/apjcp.2014.15.19.8479. PMID:25339050.
- 5 Ferlay J, Soerjomataram I, Dikshit R, et al. Cancer incidence and mortality worldwide: sources, methods and major patterns in globocan 2012. *Int J Cancer*. 2015;136:E359-86. DOI:10.1002/ijc.29210. PMID:25220842.
- 6 Jayaraj R, Singh J, Baxi S, et al. Trends in incidence

- of head and neck cancer in the northern Territory, Australia, between 2007 and 2010. *Asian Pac J Cancer Prev.* 2014;15:7753-7. DOI:10.7314/apjcp.2014.15.18.7753. PMID:25292058.
- 7 Hébuterne X, Lemarié E, Michallet M. La prévalence de la dénutrition est particulièrement élevée au cours des cancers digestifs: résultats d'une enquête nationale un jour donné. *Nutr Clin Métabol.* 2006;20:S12.
  - 8 Grant JP, Chapman G, Russell MK. Invited Review: Malabsorption associated with surgical procedures and its treatment. *Nutr Clin Pract.* 1996;11:43-52. DOI:10.1177/011542659601100243.
  - 9 Nitenberg G, Raynard B. Nutritional support of the cancer patient: issues and dilemmas. *Crit Rev Oncol Hematol.* 2000;34:137-68. DOI:10.1016/s1040-8428(00)00048-2. PMID:10838261.
  - 10 Van Cutsem E, Arends J. The causes and consequences of cancer-associated malnutrition. *Eur J Oncol Nurs.* 2005;9:S51-S63. DOI:10.1016/j.ejon.2005.09.007. PMID:16437758.
  - 11 Righini CA, Timi N, Junet P, et al. Assessment of nutritional status at the time of diagnosis in patients treated for head and neck cancer. *Eur Ann Otorhinolaryngol Head Neck Dis.* 2013;130:8-14. DOI:10.1016/j.anorl.2012.10.001. PMID:23266003.
  - 12 Prevost V, Joubert C, Heutte N, et al. Assessment of nutritional status and quality of life in patients treated for head and neck cancer. *Eur Ann Otorhinolaryngol Head Neck Dis.* 2014;131:113-20. DOI:10.1016/j.anorl.2013.06.007. PMID:24657191.
  - 13 Schmidt KN, Olson K, Kubrak C, et al. Validation of the head and neck patient symptom checklist as a nutrition impact symptom assessment tool for head and neck cancer patients. *Support Care Cancer.* 2013;21:27-34. DOI:10.1007/s00520-012-1483-y. PMID:22588710.
  - 14 Ottery FD, editor Rethinking nutritional support of the cancer patient: the new field of nutritional oncology. *Seminars in Oncology*; 1994.
  - 15 Ottery FD. Definition of standardized nutritional assessment and interventional pathways in oncology. *Nutrition.* 1996;12:S15-9. DOI:10.1016/0899-9007(95)00067-4. PMID:8850213.
  - 16 Pinato D, North B, Sharma R. A novel, externally validated inflammation-based prognostic algorithm in hepatocellular carcinoma: the prognostic nutritional index (PNI). *Br J Cancer.* 2012;106:143945. DOI:10.1038/bjc.2012.92.
  - 17 Ollenschläger G, Viell B, Thomas W, et al. Tumor anorexia: causes, assessment, treatment. *Supportive Care in Cancer Patients* II: Springer;1991.p.249-59.
  - 18 Kern K, Norton JA. Cancer cachexia. *JPEN J Parenter Enteral Nutr.*1988;12:286-98. DOI:10.1177/0148607188012003286. PMID:3292798.
  - 19 Shike M. Nutrition therapy for the cancer patient. *Hematol Oncol Clin North Am.* 1996;10:221-34. DOI:10.1016/s0889-8588(05)70336-1. PMID:8821569.
  - 20 Grant M, Ackerman D, Rivera L. Impact of dietary counselling on quality of life in head and neck patients undergoing radiation therapy. *Qual Life Res.* 1994:77-8.
  - 21 Vandewoude MF, Alish CJ, Sauer AC, et al. Malnutrition-sarcopenia syndrome: is this the future of nutrition screening and assessment for older adults? *J Aging Res.* 2012;2012:651570. DOI:10.1155/2012/651570. PMID:23024863.
  - 22 Amaral T, Antunes A, Cabral S, et al. An evaluation of three nutritional screening tools in a Portuguese oncology centre. *J Hum Nutr Diet.* 2008;21:575-83. DOI:10.1111/j.1365-277x.2008.00917.x.
  - 23 Khoshnevis N, Shahid Sales S, Alizadeh M, et al. Nutritional assessment of cancer patients by PG-SGA questionnaire in Cancer Research Center (CRC) of Shahid Beheshti University of Medical Sciences, Tehran, Iran, 2010. *Res Med.* 2012;36:132-8.
  - 24 Lees J. Incidence of weight loss in head and neck cancer patients on commencing radiotherapy treatment at a regional oncology centre. *Eur J Cancer Care (Engl).* 1999;8:133-6. PMID:10763643.
  - 25 Malá E, Vejražková E, Bielmeierová J, et al. Long term monitoring of nutritional, clinical status and quality of life in head and neck cancer patients. *Klin Onkol.* 2015;28:200-14. DOI:10.14735/amko2015200. PMID:26062622.
  - 26 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;24:429-35. DOI:10.1007/s00520-015-2813-7.
  - 27 Fernández ML, Saenz CF, Alonso SU, et al. Malnutrition in patients with cancer; four years experience. *Nutr Hosp.* 2013;28:372-81. DOI:10.3305/nh.2013.28.2.6239. PMID:23822688.
  - 28 Movahed S, Neda Mousavi S, Mozaffari V, et al. Evaluation of nutritional status of patients with malignancy in an outpatient radiation oncology clinic in Mashhad. *Med J Mashhad Uni Med Sci.* 2015;58:49-55.
  - 29 Gholami K, Harirchi I, Abdollahi LM, et al. Nutritional assessment of GI cancer patients

- at admission and seven days after major intraabdominal surgery. *DARU*. 2006;14.
- 30 Faramarzi E, Mahdavi R, Mohammad-Zadeh M, et al. Validation of nutritional risk index method against patient-generated subjective global assessment in screening malnutrition in colorectal cancer patients. *Chin J Cancer Res*. 2013;25:544. DOI:10.3978/j.issn.1000-9604.2013.10.04. PMID:24255578.