



# The High Prevalence of Malnutrition in the Cancer Patients Admitted to Omid Hospital in Mashhad, Iran Based on the PG-SGA Questionnaire (2020)

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## ABSTRACT

**Introduction:** Cancer is a major health concern and the third leading cause of death in Iran. The prevention and management of malnutrition are recognized as the inherent elements of cancer care. The present study aimed to assess the prevalence of malnutrition and the influential factors in the cancer patients admitted to Omid Hospital affiliated to Mashhad University of Medical Sciences, Iran in 2020.

**Methods:** Malnutrition was detected using the patient generated-subjective global assessment (PG-SGA) in 113 cancer patients, who were selected from the Cancer Research Center of Omid Hospital. Data analysis was performed in SPSS version 16.

**Results:** The PG-SGA scores indicated the moderate and severe prevalence of malnutrition in 3.6% and 96.4% of the cancer patients, respectively. No significant correlation was observed between the type of cancer and malnutrition due to the limited data of the patients receiving proper nutrition. However, significant correlations were denoted between the type of cancer, weight loss within the past six months, and education level of the patients ( $P < 0.05$ ). Xerostomia and anorexia were the most common dietary intake-related complaints in the cancer patients.

**Conclusion:** According to the results, the prevalence of malnutrition was extremely high in the cancer patients receiving active treatment across all the treatment settings based on the PG-SGA scores. Furthermore, anorexia was the most common cause of decreased food intake by the patients.

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## Introduction

Cancer is a systemic disease triggered by uncontrolled cell division due to environmental factors and genetic disorders (1-3). Various cancer types constitute approximately 13% of the deaths worldwide (4, 5). In 2018, roughly 18 million new cancer cases and 9.6 million cancer deaths were reported in the world, 48.5% of which occurred in Asia (6). According to recent statistics, breast, gastric, colorectal, and esophageal cancers have the highest associated mortality rates per patient in Iran (7).

Malnutrition is a common phenomenon in cancer patients, which is often overlooked (8). The prevalence of malnutrition in cancer patients has been reported to be higher than patients with other chronic diseases (9). Some of the important influential factors in

malnutrition in healthy individuals include the female gender, low education level, and low family income (10). However, the leading causes of malnutrition in cancer have been reported to be age, frequent hospitalization, tumor location, cancer stage, and symptoms; notably, cancer symptoms are positively correlated with the cancer type, cancer stage, treatment methods, and complications such as anorexia, pain, xerostomia, nausea, diarrhea, and constipation (11). The mentioned factors could also affect the appetite and dietary intake of the patients through different pathways.

Some of the significant consequences of cancer-related malnutrition include the increased risk of infection and reduced muscle function, which may in turn cause sarcopenia and cachexia (12), increased length of hospital stay, and mortality (13). Approximately 20% of cancer deaths occur

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due to malnutrition and its complications rather than the malignancy (7, 14). Furthermore, reports have suggested that patients with gastrointestinal cancer and lung cancer are at the higher risk of malnutrition comparatively although the prevalence varies in different studies (15, 16). Notably, the higher prevalence of gastrointestinal cancer could be due to the fact that it covers a wide range of cancers, including colorectal cancer, esophageal cancer, biliary system cancer, stomach cancer, and pancreatic cancer.

The patient generated-subjective global assessment (PG-SGA) is considered to be a standardized tool for the assessment of malnutrition (17-19), which has been validated for the detection of patients with malnutrition in oncology settings. Moreover, the PG-SGA has also been used in the other studies regarding malnutrition in various cancer patient populations (20-22). Unfortunately, no documented data are available on the prevalence of malnutrition in hospitalized patients in Iran although few studies have estimated the prevalence at 45% (23, 24).

Considering the insufficient data regarding the prevalence of malnutrition in cancer patients in Iran (especially Mashhad city), the present study aimed to assess the prevalence of malnutrition and the influential factors in the cancer patients admitted to Omid Hospital in Mashhad, Iran in 2020.

## Materials and Methods

### Study Design

This descriptive, cross-sectional study was conducted at Omid Hospital in Mashhad, which is affiliated to Mashhad University of Medical Sciences, during December 2019-February 2020. The study protocol was approved by Varastegan Institute for Medical Sciences Committee as part of the nutritional state assessment educational program. The ethical approval was granted to each individual, and all the patients provided verbal consent to participate.

### Patients and Variables

Based on the average prevalence of malnutrition in cancer patients as determined by the previous findings in this regard (50%) and the prevalence of the most common cancers in Omid Hospital, 113 patients were selected as the sample population. The inclusion criteria were

the age of >18 years, available data on weight change within the past six months, and willingness to participate in the study. The exclusion criteria of the study were abnormal consciousness and the presence of cognitive impairment, unstable clinical conditions, and neurodegenerative disorders in movement (e.g., stroke, Parkinson's disease, myopathy, severe arthritis, and cardiorespiratory distress).

### Measurements

Demographic data were collected on the age, gender, education level, and occupation status of the selected patients. To determine the occupation status, the patients were asked to report their working state and income status. Accordingly, they were classified into three groups of employed, daily worker (e.g., seller or manual worker), and other (e.g., retirement insurance, unemployment insurance or other).

To evaluate malnutrition, we used the standard PG-SGA for the Iranian population (25). As mentioned earlier, it is a standard tool for evaluating the risk of malnutrition in oncology and other chronic catabolic settings. The PG-SGA consists of four patient-generated historical components, including weight history, food intake, symptoms, and activities. Based on the questionnaire, the patients were classified into three groups of A (proper nutrition) with scores 0-1, B (high-risk or suspected of malnutrition) with scores 2-8, and C (malnutrition) with scores  $\geq 9$ . Correspondingly, variables such as weight loss within the past six months, dietary changes, nutrition-related complaints, physical activity, and clinical observations were surveyed (1, 13, 18).

### Procedures

Based on the weight-change records of the past six months and the most recent measured weight with the accuracy of 100 grams, the weight loss rate was determined within the past six months in the patients. In addition, the final score of the PG-SGA was calculated based on the weight loss rate within the same period. By recording the results of the clinical examinations, the scores obtained from the questionnaire were ranked in each section. In accordance with the guidelines of the questionnaire, the severity of malnutrition was defined in three levels of A (proper nutrition) with scores 0-1, B (high-risk or suspected of malnutrition) with scores 2-8, and C (malnutrition) with scores  $\geq 9$ .

### Statistical Analyses

Data analysis was performed in SPSS version 16.0 (IBM SPSS Statistics, IBM Corporation, Armonk, NY, USA), the characteristics of the patients were expressed as numbers and percentages. To compare the criteria between the patients with malnutrition, Chi-square test, t-test, and Mann-Whitney U test were used when appropriate. Moreover, the Kolmogorov-Smirnov test was applied to determine the normality of the continuous variables (height, age, and body mass index [BMI]), and the two-

tailed P-value of less than 0.05 was considered significant.

### Results

Two patients were excluded from the study, and 111 patients were examined. Among 111 cancer patients admitted to Omid Hospital, 46.8% and 53.2% were female and male, respectively. The mean age, weight, and BMI of the participants were  $48 \pm 16$  years,  $58 \pm 31$  kilograms, and  $20.7 \pm 4.6$  kg/m<sup>2</sup>. The data of the study are presented in Table 1.

**Table 1.** Malnutrition prevalence in terms of gender, age, educational level, economic status, type of cancer, treatment, and type of insurance. (N=111)

Variable	Classification	Malnutrition based on PG- SGA	
		Moderate nutrition (B)	severe malnutrition (C)
		Absolute Frequency (%)	Absolute Frequency (%)
		Number	Number
Gender	Male	2(50%)	57(53.3%)
	Female	2(50%)	50(46.7%)
	Total	4(100%)	107(100%)
Age	Less than 65 years	3(75%)	94(87.7%)
	More than 65 years	1(25%)	13(12.1%)
	Total	4(100%)	107(100%)
Educational level	Illiterate	0(0%)	21(19.6%)
	High school	2(50%)	57(53.3%)
	Diploma	0(0%)	20(18.7%)
	University education	2(50%)	9(8.3%)
	Total	4(100%)	107(100%)
Economic status	Employed	1(25%)	19(17.7%)
	Daily worker	2(50%)	35(32.7%)
	Others	1(25%)	53(49.9%)
	Total	4(100%)	107(100%)
Type of cancer	Gastrointestinal	1(25%)	60(56.1%)
	Urinary system	0(0%)	6(5.6%)
	Breast cancer	1(25%)	22(20.6%)
	Prostate cancer	0(0%)	2(1.9%)
	Lung	0(0%)	1(0.9%)
	Others	2(50%)	16(15%)
	Total	4(100%)	107(100%)
Current Treatment type	Surgery	0(0%)	26(24.3%)
	Chemotherapy	1(25%)	38(35.5%)
	Surgery	3(75%)	27(25.2%)
	Chemotherapy Combined treatments	0(0%)	16(15%)
	Total	4(100%)	107(100%)
Kind of insurance	Social Security	1(25%)	37(34.6%)
	Health Service	2(50%)	20(18.6%)
	Rural insurance	0(0%)	24(22.4%)
	Others	1(25%)	24(22.4%)
	Total	4(100%)	107(100%)

The categorical data were expressed as frequencies (n) and percentages (%). Data was not compared between groups because of low cases with moderate-nutrition, it was not logical to make statistical analysis

According to the PG-SGA questionnaire, approximately 96.4% and 3.6% of the patients had severe and moderate malnutrition, respectively. Due to the limited data on the patients receiving proper nutrition, no statistical analysis could be conducted in this regard. The cancer types examined in our study included gastrointestinal, breast, urinary, prostate, lung,

and other cancers, the prevalence rate of which was estimated at 54.9%, 20.7%, 6.3%, 4%, 5%, 8.1%, 9.0%, and 9.9%, respectively. However, no significant correlation was observed between malnutrition and the type of cancer due to the sample size. Our findings indicated a significant correlation between the severity of malnutrition and education level (P=0.01), while no

significant associations were denoted between the severity of malnutrition and occupation status, treatment type, age, gender, and insurance type. Furthermore, no significant correlation was observed between various treatment methods and malnutrition severity.

In the present study, the highest weight loss rate within the past six months was in the patients with gastrointestinal cancers, while the lowest rate belonged to the lung cancer patients. In addition, a significant association was denoted between weight loss within the past six months and type of cancer ( $P=0.04$ ). However, the

correlation between physical function and type of cancer was not considered statistically significant (Table 2).

According to the information in Table 3, the common causes of decreased dietary intake in the patients were anorexia, dry mouth, depression, financial issues, and dental problems, which were confirmed in each case by examining the medical history of the patients and interviewing a nutritionist. Anorexia and xerostomia were the most common complaints of the patients regarding the cause of their decreased food intake.

**Table 2.** Percentage of effective variables in the feeding of cancer patients in a variety of cancers. (N=111)

Variable	Gastrointestinal cancer	Urinary cancers	Breast cancer	Prostate cancer	Lung cancer	Other cancers	Total	
<b>Weight loss in the last 6 months</b>	0-1.9 %	15 (12.6%)	1 (0.9%)	8 (7.2%)	1 (0.9%)	0 (0%)	6 (5.4%)	30 (28.9%)
	2-5.9%	7 (6.3%)	2 (1.8%)	11 (9.9%)	0 (0%)	0 (0%)	2 (1.8%)	22 (20.5%)
	6-9.9%	5 (4.5%)	3 (2.7%)	1 (0.9%)	0 (0%)	0 (0%)	1 (0.9%)	10 (9.3%)
	10-19.9%	14 (14.9%)	0 (0%)	2 (1.8%)	1 (0.9%)	1 (0.9%)	1 (0.9%)	19 (17.7%)
	20%≤	8 (7.2%)	0 (0%)	1 (0.9%)	0 (0%)	0 (0%)	1 (0.9%)	10 (9.3%)
<b>Daily physical activity</b>	Normal	8 (7.2%)	2 (1.8%)	9 (8.1%)	0 (0%)	0 (0%)	8 (7.2%)	27 (25.2%)
	Minor activity limitation	6 (5.4%)	1 (0.9%)	4 (3.6%)	10 (9%)	0 (0%)	2 (1.8%)	23 (21.4%)
	Rest on the bed less than half a day	7 (6.3%)	1 (0.9%)	4 (3.6%)	0 (0%)	0 (0%)	0 (0%)	12 (11.2%)
	Rest more than half a day in the bed	16 (14.4%)	2 (1.8%)	6 (5.4%)	1 (0.9%)	1 (0.9%)	1 (0.9%)	27 (25.2%)

The categorical data were expressed as percentages (%)

**Table 3.** Frequency of Nutrition Complaints leads to Reduced Food intake in Patients with Cancer in this study (N=111)

Patient complaint	Percentage
Anorexia. Unwillingness to eat	61 (56.8%)
Xerostomia	57 (53.2%)
Others (dental problems, financial problems, and depression)	57 (53.2%)
Nausea	48 (45%)
Constipation	42 (39.6%)
Pain	35 (32.4%)
Oral sore	30 (27.9%)
dysgeusia	25 (23.4%)
Vomiting	21 (19.8%)
Dysphagia	20 (18.9%)
dysosmia	17 (16.2%)
Diarrhea	17 (16.2%)

The categorical data were expressed as percentages (%)

## Discussion

According to the results of the present study, 96.4% of the cancer patients admitted to Omid Hospital had severe malnutrition, and 3.6% had moderate malnutrition based on their PG-SGA scores. This is consistent with some of the studies conducted in Iran and other countries in this regard. For instance, a study in Tehran (Iran) indicated that the prevalence of severe

malnutrition was 23% (26), while in a cross-sectional study in Mashhad (Iran), Movahed et al. (27) reported the prevalence rate to be 38.5% in cancer outpatients (27). In another research conducted by Khoshnevis et al. (28) in Tehran on a sample size of 416 cancer patients, the PG-SGA was used to determine the prevalence of malnutrition in the patients. According to the mentioned study, 53.1% of the patients (n=221) had malnutrition, and 29.1%

and 24% were diagnosed with moderate and severe malnutrition, respectively (28). Based on the aforementioned studies, it could be inferred that the prevalence rate of malnutrition in Iran is relatively low, and no studies have reported a high prevalence as we determined in Omid Hospital in Mashhad, which could be attributed to the sample population. Most of the similar studies in Iran have been performed on cancer outpatients, while our sample population consisted of hospitalized cancer patients with severe conditions.

As for the international studies in this regard, D'Almeida et al. (29) performed a hospital-based multicenter cohort study in 44 hospitals in Brazil on 3,061 cancer patients, reporting the prevalence of malnutrition, risk of malnutrition, and proper nutrition to be 33.4%, 39.3%, and 27.3%, respectively. However, the malnutrition assessment tool in the mentioned study was the mini nutritional assessment-short form (29). In a study conducted by Wiegert et al. in Brazil (30) on a sample size of 120 patients, the PG-SGA was applied for nutritional assessment, and the prevalence rate of malnutrition was high (94.2%) (30), which is in line with our findings. In addition, Wie et al. (11) examined a sample size of 14,972 cases in South Korea, reporting the rate of malnutrition to be 61%. In another study by Zhu et al. (31) in China, the PG-SGA was used for the nutritional assessment of 525 individuals, and the prevalence of malnutrition was estimated at 46.6% with the same cutoff as the present study (31). In another research performed in Thailand by Nitichai et al. (32), 195 cancer patients were assessed using the PG-SGA, and the prevalence of severe and moderate malnutrition was reported to be 34% and 27%, respectively (32).

Studies have reported varied prevalence rates of malnutrition in cancer patients within the range of 23-94.2% in different countries and institutions. In some cases, a substantial discrepancy could be observed between the studies conducted in the same countries, showing the importance of the nutritional management of institutions rather than national and international nutritional policies. In the present study, not only 100% of the patients had malnutrition, but also 96.4% had severe malnutrition, which indicated the lack of proper nutritional support in the selected hospital. Therefore, drafting a healthy nutritional

program for Omid Hospital in Mashhad is highly recommended.

Several studies have confirmed the effects of cancer type, cancer stage, and tumor location on the severity of malnutrition in the patients (11, 16, 33). However, our findings demonstrated no correlation between the type of cancer and malnutrition, which was mainly due to the sample size of the patient subgroups. On the other hand, a significant association was observed between weight loss within the past six months and cancer type. Weight loss is an important indicator of malnutrition, especially in diseased states (34-36). This variable had the highest prevalence among the gastrointestinal cancer patients in the current research and the lowest rate among the lung cancer patients. In the study by Wie et al., lung cancer patients (60.5%) had the second highest prevalence of malnutrition after gastrointestinal cancer patients (86.6%), while breast cancer patients (0.3%) showed the lowest prevalence (11). Despite the variations in the findings in this regard, patients with lung cancer and gastrointestinal cancers (especially esophageal and liver cancers) are at the higher risk of malnutrition (11, 15, 16, 33, 37). However, the significant correlation between weight loss and malnutrition cannot be supported due to the lack of solid evidence in this respect. On the other hand, evidence attests to the risk and severity of malnutrition and their significant, direct associations with the type of cancer (11, 38-40). Notably, our findings indicated no significant correlation between the type of treatment and risk of malnutrition in the sample population. Some findings have suggested that treatments such as surgery, radiotherapy, chemotherapy, surgery-chemotherapy, and other combined treatments could affect the risk of malnutrition (11, 16, 38).

The results of the present study indicated no significant association between age and the risk of malnutrition in the cancer patients. Conversely, Wie et al. (11) evaluated a sample size of 14,972 patients and reported a significant correlation between age and the risk of malnutrition in cancer patients. The proposed findings on age and gender vary in different studies although the risk of malnutrition has been reported to increase with ageing. As for gender, women tend to follow nutritional consultations better than men, which has been

reported to lower the risk of malnutrition in women (7, 10, 11, 31, 38-40).

Our findings demonstrated no significant associations between insurance, occupation status, and type of cancer with malnutrition, while the correlation between education level and malnutrition was considered significant. Previous studies have also confirmed that individuals with higher education levels respond better to nutritional education and are at a lower risk of malnutrition (10, 12, 41, 42). Furthermore, the results of the present study indicated no significant correlation between physical function and type of cancer, while the patients with gastrointestinal cancers reported lower daily activity. Physical function is essential to effective cancer treatment (8, 16, 41, 43).

According to the current research, the most common nutritional complaints among the cancer patients were anorexia, xerostomia, dental problems, financial issues, depression, nausea, constipation, and pain (Table 3). This is in line with the previous findings in this regard, proposing anorexia, xerostomia, nausea, and pain to be the foremost complaints of cancer patients (11, 16, 22, 26, 31-33). Therefore, controlling these complaints could enhance the nutritional intake of cancer patients, while the impact should be thoroughly analyzed in further studies.

The main limitation of the present study was the small sample size, and we could not statistically analyze the effect of the cancer type on malnutrition in the patients. In addition, all the patients had malnutrition and had no proper nutrition, which complicated the statistical analysis. Nonetheless, we managed to propose essential data regarding the malnutrition state of the cancer patients requiring emergency nutritional interventions.

## Conclusion

Our findings provided a comprehensive description by reporting 100% malnutrition prevalence rate in the cancer patients receiving active treatment across all treatment settings based on the PG-SGA, which requires urgent attention. According to the results, anorexia was the most important cause of low dietary intake. In conclusion, it is suggested that active, continuous nutritional assessment and interventions be carried out during cancer

treatment in order to prevent malnutrition and its complications.

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## Conflict of interest

Authors declare no conflict of interest.

## References

1. Heery CR, Ibrahim NK, Arlen PM, Mohebtash M, Murray JL, Koenig K, et al. Docetaxel alone or in combination with a therapeutic cancer vaccine (PANVAC) in patients with metastatic breast cancer: a randomized clinical trial. *JAMA oncology*. 2015;1(8):1087-95.
2. Siegel RL, Miller KD, Fedewa SA, Ahnen DJ, Meester RG, Barzi A, et al. Colorectal cancer statistics, 2017. *CA: a cancer journal for clinicians*. 2017;67(3):177-93.
3. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a cancer journal for clinicians*. 2018;68(6):394-424.
4. Valipour AA, Mohammadian M, Ghafari M, Mohammadian-Hafshejani A. Predict the future incidence and mortality of breast cancer in Iran from 2012-2035. *Iranian journal of public health*. 2017;46(4):579-80.
5. Ryan AM, Power DG, Daly L, Cushen SJ, Bhuachalla EN, Prado CM. Cancer-associated malnutrition, cachexia and sarcopenia: the skeleton in the hospital closet 40 years later. *Proceedings of the Nutrition Society*. 2016;75(2):199-211.
6. D'Almeida CA PW, De Pinho NB, Martucci RB, Rodrigues VD, Ramalho A. Prevalence of Malnutrition in Older Hospitalized Cancer Patients: A Multicenter and Multiregional Study. *The journal of nutrition, health & aging*. 2020;1;24(2):166-71.
7. Chao P-C, Chuang H-J, Tsao L-Y, Chen P-Y, Hsu C-F, Lin H-C, et al. The Malnutrition Universal Screening Tool (MUST) and a nutrition education program for high risk cancer patients: strategies to improve dietary intake in cancer patients. *Biomedicine*. 2015;5(3).
8. Nitichai N, Angkatavanich J, Somlaw N, Voravud N, Lertbutsayanukul C. Validation of the Scored Patient-Generated Subjective Global Assessment (PG-SGA) in Thai Setting and Association with Nutritional Parameters in Cancer Patients. *Asian Pacific Journal of Cancer Prevention*. 2019;20(4):1249-55.
9. e Melo Silva FR, de Oliveira MGOA, Souza ASR, Figueroa JN, Santos CS. Factors associated with malnutrition in hospitalized cancer patients: a cross-sectional study. *Nutrition journal*. 2015;14(1):123.

10. F O. Patient generated subjective global assessment. In: McCallum P, Polisena C, editors. The clinical guide to oncology. Chicago IL. The American Dietetic Association. 2000;11-23.
11. Marshall KM, Loeliger J, Nolte L, Kelaart A, Kiss NK. Prevalence of malnutrition and impact on clinical outcomes in cancer services: a comparison of two time points. *Clinical nutrition*. 2019;38(2):644-51.
12. Badosa EL, Tahull MB, Casas NV, Sangrador GE, Méndez CF, Meseguer IH, et al. Hospital malnutrition screening at admission: malnutrition increases mortality and length of stay. *Nutricion hospitalaria*. 2017;34(4):907-13.
13. Thomas MN, Kufeldt J, Kisser U, Hornung H-M, Hoffmann J, Andraschko M, et al. Effects of malnutrition on complication rates, length of hospital stay, and revenue in elective surgical patients in the G-DRG-system. *Nutrition*. 2016;32(2):249-54.
14. Ghoreishi Z, Shahabbasi J, Jager-Wittenaar H, Ottery F, Jafarabadi MA, Dolatkah R, et al. MON-PO538: Cross Cultural Adaptation and Validation of the 'Patient-Generated Subjective Global Assessment (PG-SGA)' for Nutritional Status Assessment of Cancer Patients in Iran. *Clinical Nutrition*. 2019;38:S258.
15. Bauer J, Capra S, Ferguson M. Use of the scored Patient-Generated Subjective Global Assessment (PG-SGA) as a nutrition assessment tool in patients with cancer. *European journal of clinical nutrition*. 2002;56(8):779.
16. Sarvarian R, Khoshnevis N, Amiri Z, Haghghian Roudsari A, Rashidi A. Prevalence of malnutrition and its relationship to socio-economic variables for cancer patients admitted to Shohada-ye-Tajrish hospital in 2010. *Nutr Sci Food Technol*. 2013;8(3):261-7.
17. Movahed S, Neda Mousavi S, Mozaffari V, Makhdoumi Y, Zeraati A, Firuzabadi P, et al. Evaluation of nutritional status of patients with malignancy in an outpatient radiation oncology clinic in Mashhad. *Med J Mashhad Univ Med Sci*. 2015;58(1):49-55.
18. Gholami SS, Ardekani TM, Karami K, Taheri A, Gholamnezhad M. Evaluation of malnutrition status in patients admitted to Shahid Rajaei hospital in Gachsaran City in 2016. *Middle East Journal of Family Medicine*. 2017;7(10):150.
19. Movahedi M, Haghghat S, Khayamzadeh M, Moradi A, Ghanbari-Motlagh A, Mirzaei H, et al. Survival rate of breast cancer based on geographical variation in Iran, a national study. *Iran Red Crescent Med J*. 2012;14(12):798.
20. Zarif Yeganeh M, Eghtesadi S, Vakili M, Faghih A, Haghani H, Noormohammadi I, et al. Nutritional assessment of cancer patients during chemotherapy in Iran University of medical sciences affiliated hospitals, 2006-2007. *Razi j Med Sci*. 2009;16:0-.
21. Kabir M, Keshtkar A, Lashkar BF. Prevalence of malnutrition in children under 2 years old and its relationship with mothers background variables in Golestan province. 2006.
22. KIMIAGAR SM, Bazhan M. Poverty and malnutrition in Iran. 2005.
23. Pirlich M, Schütz T, Kemps M, Luhman N, Minko N, Lübke HJ, et al. Social risk factors for hospital malnutrition. *Nutrition*. 2005;21(3):295-300.
24. Read JA, Choy SB, Beale P, Clarke SJ. An evaluation of the prevalence of malnutrition in cancer patients attending the outpatient oncology clinic. *Asia-Pacific Journal of Clinical Oncology*. 2006;2(2):80-6.
25. Naber TH, Schermer T, de Bree A, Nusteling K, Eggink L, Kruijmel JW, et al. Prevalence of malnutrition in nonsurgical hospitalized patients and its association with disease complications. *The American journal of clinical nutrition*. 1997;66(5):1232-9.