

ORIGINAL ARTICLE

Nutritional Status and Its Related Factors among Elderly Nursing Home Residents

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ABSTRACT

Background: Elderly population are at higher risk of malnutrition that can increase the morbidity and mortality among them. This study aimed to evaluate the nutritional status and the related factors among elderly nursing home residents.

Methods: This descriptive cross-sectional study enrolled 1062 (439 males, 623 females) elderly living in the elderly nursing home residents in Mashhad, Iran. The nutritional status of participants was assessed through a Mini Nutritional Assessment-Short Form scale and Nutrition Day questionnaires.

Results: Among the study participants, 64 (18.5%) were malnourished, 142 (31.9%) were at risk of malnutrition, and 94 (49.6%) were well-nourished. Moreover, elderly females were more susceptible to the risk of malnutrition and malnutrition ($p=0.007$ and $p=0.02$, respectively). Furthermore, reduced food intake in the past three months, calf circumference of less than 31cm, lower BMI, worse cognition, and feeding aid were significantly related to the risk of malnutrition ($p=0.04$, $p<0.001$, $p<0.001$, and $p<0.001$, respectively) and malnutrition ($p<0.001$, $p<0.001$, $p<0.001$, and $p<0.001$, respectively) in elderly participants. Furthermore, weight reduction in the last 3 months and care levels were significantly associated with malnutrition ($p<0.001$ and $p<0.001$, respectively). Also, the lower number of nurses and the presence of people who care about nutritional status were significantly associated with the higher malnutrition rate in elderly participants ($p=0.02$, $p=0.03$, respectively).

Conclusion: The present study showed that more than half of the elderly population living in elderly nursing homes were malnourished or at risk of malnutrition.

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Introduction

Ageing or senescence, defined as the age of ≥ 65 years old, is considered a biological process with various changes in cellular and organ systems

including neurological, gastrointestinal, renal, cardiovascular, respiratory and endocrine systems (1). The World Bank in 2021 has reported the population aged 65 years and above in the world

and Iran to be 9.539 and 6.80 million, respectively. World Health Organization (WHO) has also estimated the world population of people aged 60 years and older to be doubled by 2050 (2.1 billion) (2). Considering the demographic structure of Iran, this country is regarded as one of the fastest ageing regions in the world (3); while the critical component among elderly population is providing sufficient nutrients (4). Furthermore, older people are predisposed to disease-related weight loss, sarcopenia, frailty syndrome, anorexia of ageing, depressive or cognitive disorders, and decreased socio-economic status (SES), which can further lead to malnutrition (4). Moreover, among the older adults, malnutrition has significant implications that can worsen the recovery from illnesses and can increase the morbidity and mortality of acute and chronic diseases among elderly population (5). This condition is also associated with a severe burden on the healthcare system (6).

It was demonstrated that the prevalence of malnutrition among the community settings and hospitals of all countries has been 8.5% and 28.0%, respectively (7). Due to the increase of malnutrition among elderly people, it is essential to assess the nutritional status of this ageing group. The Mini Nutritional Assessment (MNA) is a standard nutritional tool to determine the nutritional status of older adults in outpatient clinics, hospitals, and nursing homes (8). MNA is considered essential for diagnosing and planning of an appropriate treatment (8). Nutritional status in older adults is a neglected subject which requires proper assessment. Based on available evidences, determining the nutritional status of the elderly population in order to provide an early nutritional intervention is important to reduce the medical, poor clinical outcomes, and economical burdens in this population. Moreover, limited studies have assessed the nutritional status among elderly population in nursing homes in Iran (9, 10); even they had a small sample size which could reduce the power of those studies. Therefore, this study aimed to assess the nutritional status of nursing homes among elderly residents in Mashhad, Iran.

Materials and Methods

In a cross-sectional study, 1062 (439 men, 623 women) elderly residents of Mashhad nursing home were enrolled. The participants were selected from the elderly of 21 nursing homes in Mashhad, Iran based on the inclusion and exclusion criteria between May and October 2018. After explaining the study objectives, advantages, disadvantages and limitations to the elderly population, a consent form was obtained from the volunteers/carers of this

group to participate in the study. The participants were chosen based on a convenience sampling method, considering the inclusion and exclusion criteria. Participants were called separately to conduct a face-to-face interview and to complete the questionnaires. For those individuals who were unable to move, the researchers referred to the location of their choice.

The inclusion criteria were (i) To be elderly aged 60 years and older, (ii) Living in nursing homes for at least three months, and (iii) To be consent to participate in the study. This cross-sectional study was confirmed by the Mashhad University of Medical Science Ethics Committee with the ethics code of IR.MUMS.FM.REC.1396.415. Malnutrition was considered as an outcome. Gender, reduced food intake in last three months, weight loss in last three months, calf circumference, body mass index (BMI), weight reduction in previous year, cognition status, care level, feeding aid, number of beds, number of managing nurses, number of staff assistants, number of dieticians and dietetic assistants, and presence of a person who cared about nutritional status were investigated.

Cognition status was evaluated by using the Mini Mental State Examination (MMSE) (11). A normal cognitive score was a score of 24 or higher (out of 30). Scores below this level presented mild (19-23 points), moderate (10-18 points), or severe (≤ 9 points) cognitive impairments. The anthropometric parameters such as weight, height, BMI, and calf circumference were measured. Body weight was measured to the nearest 0.1 kg, while participants were without shoes and in minimal clothing using a digital scale (Seca, Hamburg, Germany). Height was evaluated by a nonstretched tape measure (Seca, Hamburg, Germany) to the nearest 0.1 cm. BMI was calculated as weight in kg divided by height in meters squared. In some instances where it was not possible to measure standing height, the ulnar length was used to estimate the height. People who were unable to stand, the BMI was determined by measuring the mid-arm circumference (a non-stretched tape measured MUAC at the mid-point between the tip of the shoulder and elbow) (12). Weight was categorized based on BMI according to the National Institutes of Health (NIH) (<18.5: Underweight, 18.5-24.9: Average weight, 25-29.9: Overweight, 30-34.9: First-degree obesity, 35-39.9: Second-degree obesity, and equal to or more than 40: Severe obesity). Calf circumference was measured in a position where the person was sitting on a chair. When the calf and thigh were at a 90 degrees angle; the circumference of the most prominent part of the leg muscle was measured (13).

The nutritional status of the elderly was evaluated by the Mini Nutritional Assessment Scale-Short Form (up to 14 scores), which contained six sections and 18 questions (14). It assessed weight loss, loss of appetite, mobility, acute illness, mental stress, calf circumference and BMI. The score of each question ranged from 0 to 3 for screening the risk of malnutrition that were totally divided into three groups of (a) Malnutrition (0-7), (b) At risk of malnutrition (8-11), and (c) Adequate nutrition (12-14) (15). Other anthropometric, food intake and clinical data of participants were collected based on Nutrition Day Questionnaire, which was consisted of four questionnaires regarding information about the nursing home, structures and organizations, information specific to the elderly, monitoring weight and mobility, social communication, nutritional habits, appetite and food intake (16). Physical stress in last three month was determined by questions about incidence of injury, bone fracture, or any acute condition during this period. Also, mental stress in the last three month was investigated if the patient experienced any condition that affected the mental health such as anxiety, stress, depression, death of relatives, family disputes, decrease in financial income, etc.

The sample size was calculated based on Ebrahimi Fakhar's study (17). In this study, the prevalence of malnutrition in older people living in nursing homes was 19.6%, with a confidence of 95% and an accuracy of 2.5%. So the sample size was calculated as 972 subjects, and finally, the sample size was determined as 1062 individuals. The statistical package for social sciences (SPSS) software (Version 18, Chicago, IL, USA) was used to perform the analysis. The normality of continuous variables was evaluated using the Kolmogorov-Smirnov test. The distribution of categorical variables among all groups was presented by frequency and percentage. A comparison of continuous variables between groups was performed using the One-Way Analysis of Variance (ANOVA). In contrast, the distribution pattern of categorical variables between groups was compared utilizing the Chi-Square test. Furthermore, multinomial logistic regression models were designed to identify the predictors of nutritional status. The odds ratio (OR), 95% confidence interval (CI) for OR and *p* values were reported for the regression analysis. The level of statistical significance was set as *p*<0.05.

Results

Table 1 shows the distribution of socio-demographic characteristics of the participants. Among 1062 elderly population (439 males and 623 females) participating in this study, the mean age was

Table 1: General characteristics of participants.

Variable	Changes
Age (y)	^a 77.2±16
Height (cm)	162.72±4.74
Weight (kg)	62.85±10.55
BMI (kg/m ²)	N (%)
Less than 18.5	42 (3)
18.5-23	519 (48)
More than 23	501 (47)
Gender	
Male	41.3 (439)
Female	58.7 (623)
Mental/ Physical stress during last 3 month	
Yes	308 (29)
No	754 (71)

^aMeans±SDs. BMI: Body mass index.

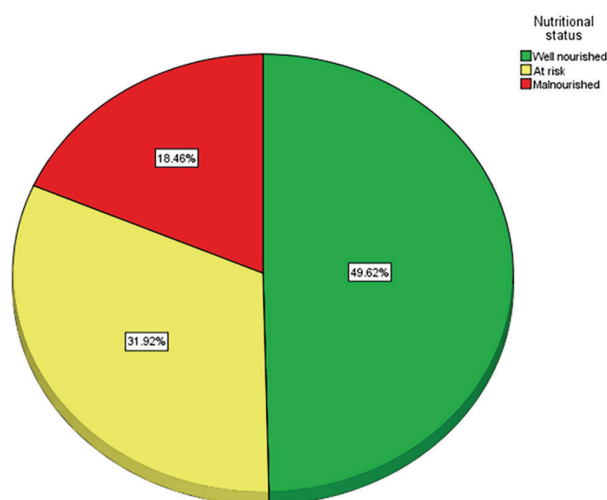


Figure 1: Distribution of nutritional status based on MNA scale.

77.2 years; the majority was female (58.7%) and 23.57% were in the age range of 60-80 years. The mean±SD for height and weight of the participants were 162.72±4.74 and 62.85±10.55, respectively. Among the study participants, 64 (18.5%) were malnourished, 142 (31.9%) were at risk of malnutrition and 94 (49.6%) had no malnutrition (Figure 1). The prevalence of underweight, normal weight, overweight or obesity among the participants was 3%, 48%, and 47%, respectively.

Table 2 reveals the anthropometric indices' and the participants' nutritional status. The assessment of the nutritional status of the elderly in relation to gender showed that elderly females were more susceptible to malnutrition (*p*=0.03). Moreover, reduced food intake in the past three months, calf circumference less than 31 cm, lower BMI, impaired cognitive status, and feeding aid were significantly associated with the risk of malnutrition (*p*=0.04, *p*<0.001, *p*<0.001, *p*<0.001, and *p*<0.001, respectively). Furthermore, weight reduction and reduced food intake in the past three

Table 2: Distribution of nutritional status in relation to anthropometric parameters and past nutritional intakes

	Malnourished		At risk of malnutrition	
	P-value	OR (95% CI)	P-value	OR (95% CI)
Gender (female) ^a	<0.007	0.62 (0.44-0.87)	0.02	0.72 (0.54-0.95)
Reduced food intake in past 3 months	<0.001	6.11 (4.36-8.57)	0.04	1.44 (1.01-2.06)
Weight reduction in the past 3 months	<0.001	12.86 (8.34-19.83)	0.14	1.42 (0.88-2.30)
CC<31cm ^b	<0.001	121.08 (68.75-213.24)	<0.001	75.18 (46.96-120.35)
Higher BMI	<0.001	0.04 (0.03-0.07)	<0.001	0.19 (0.15-0.24)
Worse cognitive status	<0.001	6.32 (4.90-8.15)	<0.001	2.54 (2.06-3.14)
Higher Care Level	<0.001	3.15 (2.55-3.91)	0.28	1.11 (0.91-1.35)
Feeding aid	<0.001	0.37 (0.30-0.47)	<0.001	0.53 (0.42-0.65)

In the logistic regression model, Well-nourished state was considered as a reference. a) Male gender was considered as a reference; b) CC \geq 31 was considered as a reference. CC: Calf circumference; BMI: Body Mass Index; OR: odds ratio; CI: confidence interval. BMI was defined as an ordinal variable, including <19, 19-21, 21-23, and >23 kg/m². Cognition was defined as an ordinal variable, including normal, mild to moderate disability, and severe disability. Care Level was defined as an ordinal variable, including less than 45 minutes (min), 45-119 min, 120-239 min more than 240 min

Table 3: Nutritional status in relation to elderly nursing home condition.

Variable	Malnourished		At risk of malnutrition	
	P value	OR (95% CI)	P value	OR (95% CI)
Number of beds	0.391	1.00 (0.98-1.03)	0.239	1.00 (0.99-1.02)
Managing nurses	0.889	1.06 (0.45-2.50)	0.436	1.26 (0.69-2.30)
Number of nurses	0.430	0.60 (0.17-2.09)	0.028	0.42 (0.19-0.91)
Number of staff assistants	0.809	1.03 (0.78-1.36)	0.261	1.11 (0.92-1.35)
Number of dietitians and dietetic assistants	0.924	1.10 (0.13-8.93)	0.172	2.42 (0.68-8.67)
Presence of a person who cares about nutritional status	0.132	0.45 (0.16-1.26)	0.038	0.46 (0.22-0.95)

In the logistic regression model, well-nourished state was considered as reference. Among the dependent variables, female gender was considered as reference. OR: Odds ratio; CI: Confidence interval. In the logistic regression model, well-nourished state was considered as reference.

months, calf circumference of less than 31 cm, lower BMI, impaired cognitive status, higher level of care, and feeding aid were significantly associated with malnutrition ($p>0.001$, $p>0.001$, $p>0.001$, $p>0.001$, $p>0.001$, $p>0.001$, and $p>0.001$, respectively). Table 3 indicates the distribution of nursing home staff according to nutritional status. It was shown that the lower number of nurses and people who were monitoring nutritional status were significantly correlated to a higher malnutrition rate in elderly participants ($p=0.02$, $p=0.03$, respectively).

Discussion

This study illustrated that most of the elderly population (49.6%) had proper nutritional status; however, 31.9% of the subjects were at a high risk of malnutrition, and 18.5% of them were already malnourished. These findings are consistent with previous studies not only in Iran including Tabriz (18) and Damekan (19), but also; in other countries studies such as Spain (20), Switzerland (21), Sweden (22), Belgium (23), Syria (24), France (25), South Ethiopia (26), Brazil (27), Indonesia

(28), and Finland (29). The present study observed a significant relationship between nutritional status and calf circumference. People with a calf circumference less than 31 cm were at risk of malnutrition which is consistent with a similar study in Gorgan (30). In this regard, the study conducted by Ren *et al.* demonstrated that the calf circumference among adults aged over 80 years and with nutritional risk was significantly lower than individuals without any nutritional risk. Also, this study revealed that increase in calf circumference could be considered a protective factor against malnutritional risk (31).

Furthermore, in elderly people in nursing homes, a significant relationship was noticed between nutritional status and mental stress or acute illness in the last three months. Perhaps, the reason for this condition is the increased need for protein in acute diseases, physical stress and mental stimulation (32). For example, Hallit *et al.* reported that increased somatic anxiety could be significantly associated with a lower MNA score in elderly (33). Furthermore, depression was identified as one of

the major causes of poor nutritional status in elderly adults (34). In our study, impairment of cognitive status was significantly associated with malnutrition. In this regard in line with the results of our study, Sun *et al.* mentioned a linear relationship between malnutrition risk and cognitive function in older Chinese population (35). In the present study, a significant relationship was seen between the poor nutritional status and the decrease in food intake during the last three months. This finding confirmed that the identification of a reduced food intake can be one of the main reasons for malnutrition (36). Furthermore, one of the possible causes of reduced food intake in the elderly can be attributed to food insecurity, which is significantly common in malnourished patients that can also significantly increase the risk of malnutrition (37).

The study results showed a significant relationship between nutritional status and the level of care in the residents of nursing homes. In this regard, Lashkarboloki *et al.* demonstrated that the consumption of more than 3 drugs in a day was significantly related to the poor nutritional status, and the frequency of elderly people who consumed more than 3 drugs per day in the group of malnourished patients was almost twice the frequency of these people in the group without malnutrition (38). Moreover, Eteraf *et al.* displayed that people needing more care and medication during the day suffered more from weakness, sleepiness, and loss of appetite than other elderly people (39). These conditions could lead to a reduction in food and nutrients intake and eventually could result in malnutrition.

The high sample size and the use of the Nutrition Day questionnaire along with the Mini Nutritional Assessment Form (MNA-SF) were the most important strengths of this cross-sectional study. Although this study had some limitations. The main limitations of our study were unwillingness of cooperation of some of the studied subjects with our group and the lack of knowledge of the studied subjects about some of their physical changes related to malnutrition.

Conclusion

The present study showed that more than half of the elderly population were malnourished or at risk of malnutrition. Furthermore, reduced food intake and weight loss in the past three months, lower BMI, calf circumference less than 31 cm, impaired cognition, higher care level, and feeding aid were related to malnutrition. Therefore, it is recommended to conduct educational programs, interventions and cohort studies to improve the nutritional status of older people.

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Authors' Contribution

Taksha N, Norouzy A, designed, performed and conducted theory of the study. Taksha N collected the data. Jafarzadeh Esfehiani A and Gheflati A supported in statistical analysis. Rahbarinejad P, Shahraki Jazinaki M, Norouzy A, Gheflati A, Taksha N wrote the manuscript. All authors read and approved the final manuscript.

Conflict of Interest

None declared.

References

- 1 Norman K, Haß U, Pirlich M. Malnutrition in older adults—recent advances and remaining challenges. *Nutrients*. 2021;13:2764. DOI: 10.3390/nu13082764. PMID: 34444924.
- 2 Naja S, Makhoulouf M, Chehab MAH. An ageing world of the 21st century: a literature review. *Int J Community Med Public Health*. 2017;4:4363-9.
- 3 Anbari-Nogyni Z, Zimorovat A, Gheflati A, et al. Food Security Status and Its Related Factors in the Elderly in Yazd. *J Nutr Food Sec*. 2022;7:227-36.
- 4 Hickson M. Malnutrition and ageing. *Postgrad Med J*. 2006;82:2-8. DOI: 10.1136/pgmj.2005.037564. PMID: 16397072.
- 5 Norman K, Pichard C, Lochs H, et al. Prognostic impact of disease-related malnutrition. *Clin Nutr*. 2008;27:5-15. DOI: 10.1016/j.clnu.2007.10.007. PMID: 18061312.
- 6 Khalatbari-Soltani S, Marques-Vidal P. The economic cost of hospital malnutrition in Europe; a narrative review. *Clin Nutr ESPEN*. 2015;10:e89-e94. DOI: 10.1016/j.clnesp.2015.04.003. PMID: 28531387.
- 7 Leij-Halfwerk S, Verwijs MH, van Houdt S, et al. Prevalence of protein-energy malnutrition risk in European older adults in community, residential and hospital settings, according to 22 malnutrition screening tools validated for use in adults ≥ 65 years: a systematic review and meta-analysis. *Maturitas*. 2019;126:80-9. DOI: 10.1016/j.maturitas.2019.05.006. PMID: 31239123.
- 8 Russell C, Elia M. Nutrition Screening Survey in the UK and Republic of Ireland in 2010. A report by BAPEN. 2011;6.
- 9 Shahabi R, Jovein AM, Asl NM. Nutritional

- status of the elderly living in nursing homes in Sabzevar, Iran. *J Clin Basic Res.* 2019;3:18-22.
- 10 Dehdari T, Delvarianzadeh M, Ariaeean N, et al. Nutritional status and its related factors in older people residing in nursing homes in Semnan province, Iran, 2017. *Iranian J Ageing.* 2019;14:224-35.
 - 11 Ansari NN, Naghdi S, Hasson S, et al. Validation of a Mini-Mental State Examination (MMSE) for the Persian population: a pilot study. *Appl Neuropsychol.* 2010;17:190-5. DOI: 10.1080/09084282.2010.499773. PMID: 20799110.
 - 12 Benítez Brito N, Suárez Llanos JP, Fuentes Ferrer M, et al. Relationship between mid-upper arm circumference and body mass index in inpatients. *PLoS one.* 2016;11:e0160480. DOI: 10.1371/journal.pone.0160480. PMID: 27494612.
 - 13 Kusaka S, Takahashi T, Hiyama Y, et al. Large calf circumference indicates non-sarcopenia despite body mass. *J Phys Ther Sci.* 2017;29:1925-8. DOI: 10.1589/jpts.29.1925. PMID: 29200625.
 - 14 Cereda E. Mini nutritional assessment. *Curr Opin Clin Nutr Metab Care.* 2012;15:29-41. DOI: 10.1097/MCO.0b013e32834d7647. PMID: 22037014.
 - 15 Rubenstein LZ, Harker JO, Salvà A, et al. Screening for undernutrition in geriatric practice: developing the short-form mini-nutritional assessment (MNA-SF). *J Gerontol A Biol Sci Med Sci.* 2001;56:M366-M72. DOI: 10.1093/gerona/56.6.m366. PMID: 11382797.
 - 16 Valentini L, Schindler K, Schlaffer R, et al. The first nutritionDay in nursing homes: participation may improve malnutrition awareness. *Clin Nutr.* 2009;28:109-16. DOI: 10.1016/j.clnu.2009.01.021. PMID: 19264381.
 - 17 Ebrahimi Fakhar MR, Zand S. Nutritional status and associated factors in elderly residents in nursing homes. *Health Monitor J Iranian Institute Health Sci Res.* 2013;12:143-9.
 - 18 Karamzad N, Saghafi AM, Ebrahimi M, et al. Association of nutritional status with anthropometric measures and demographic factors in the elderly living at tabriz nursing homes. 2014.
 - 19 Dehdari T, Delvarianzadeh M, Araeean N, et al. Association of Demographic and Some Age Related With Nutritional Status in Elderly in Nurs-ing Home in Semnan. *Iranian J Ageing.* 2018.
 - 20 Ruiz-López MD, Artacho R, Oliva P, et al. Nutritional risk in institutionalized older women determined by the Mini Nutritional Assessment test: what are the main factors? *Nutrition.* 2003;19:767-71. DOI: 10.1016/s0899-9007(03)00125-4. PMID: 12921887.
 - 21 Griep MI, Mets TF, Collys K, et al. Risk of malnutrition in retirement homes elderly persons measured by the “mini-nutritional assessment”. *J Gerontol A Biol Sci Med Sci.* 2000;55:M57-M63. DOI: 10.1093/gerona/55.2.m57.
 - 22 Christensson L, Unosson M, Ek AC. Evaluation of nutritional assessment techniques in elderly people newly admitted to municipal care. *Eur J Clin Nutr.* 2002;56:810-8. DOI: 10.1038/sj.ejcn.1601394. PMID: 12209369.
 - 23 Gazzotti C, Albert A, Pepinster A, et al. Clinical usefulness of the mini nutritional assessment (MNA) scale in geriatric medicine. *J Nutr Health Aging.* 2000;4:176-81. PMID: 10936907.
 - 24 FA H. Assessment of the nutritional status of residents in homes for the elderly in Lattakia, Syrian Arab Republic. *East Mediterr Health J.* 2015;21:753-61. DOI: 10.26719/2015.21.10.753. PMID: 26750166.
 - 25 Torres MJ, Dorigny B, Kuhn M, et al. Nutritional status in community-dwelling elderly in France in urban and rural areas. *PLoS One.* 2014;9:e105137. DOI: 10.1371/journal.pone.0105137. PMID: 25133755.
 - 26 Hailemariam H, Singh P, Fekadu T. Evaluation of mini nutrition assessment (MNA) tool among community dwelling elderly in urban community of Hawassa city, Southern Ethiopia. *BMC Nutrition.* 2016;2:1-6.
 - 27 De Lima C, Moraes F, Cristine Souza L. Nutritional status and associated factors in institutionalized elderly. *J Nutr Disorders Ther.* 2012;2:2161-0509.
 - 28 Darmiaty D, Jafar N, Malasari S. Screening and Assessment of Nutritional Status on Elderly in Pampang, Makassar. *Indonesian Contemporary Nursing J.* 2017:86-93.
 - 29 Salminen KS, Suominen M, Soini H, et al. Associations between nutritional status and health-related quality of life among long-term care residents in Helsinki. *J Nutr Health Aging.* 2019;23:474-8. DOI: 10.1007/s12603-019-1182-1. PMID: 31021365.
 - 30 Eftekhari ardebili H, Lashkar boloki F, Jazayeri A, et al. Nutritional status of elderly people. *J School Public Health Institute Public Health Res.* 2014;12:59-68.
 - 31 Ren C, Zhang X, Zhu Y, et al. Low calf circumference can predict nutritional risk and mortality in adults with metabolic syndrome aged over 80 years. *BMC Endocr Disord.* 2022;22:47. DOI: 10.1186/s12902-022-00964-1. PMID: 35193560.

- 32 Mahan LK, Escott-Stump S. Krause's food, nutrition, & diet therapy: Saunders Philadelphia; 2004.
- 33 Hallit S, Daher MC, Hallit R, et al. Correlates associated with mental health and nutritional status in Lebanese older adults: A cross-sectional study. *Arch Gerontol Geriatr.* 2020;87:103879. DOI: 10.1016/j.archger.2019.05.004. PMID: 31160065.
- 34 Morley J, Miller D, Perry H, et al. Anorexia of aging, leptin, and the Mini Nutritional Assessment. *Nestle Nutr Workshop Ser Clin Perform Programme.* 1999;1:67-76. DOI: 10.1159/000062949. PMID: 11490597.
- 35 Sun B, Zhao Y, Lu W, et al. The Relationship of Malnutrition With Cognitive Function in the Older Chinese Population: Evidence From the Chinese Longitudinal Healthy Longevity Survey Study. *Front Aging Neurosci.* 2021;13:766159. DOI: 10.3389/fnagi.2021.766159. PMID: 34880747.
- 36 Saunders J, Smith T. Malnutrition: causes and consequences. *Clin Med (Lond).* 2010;10:624-7. DOI: 10.7861/clinmedicine.10-6-624. PMID: 21413492.
- 37 Grammatikopoulou MG, Gkiouras K, Theodoridis X, et al. Food insecurity increases the risk of malnutrition among community-dwelling older adults. *Maturitas.* 2019;119:8-13. DOI: 10.1016/j.maturitas.2018.10.009. PMID: 30502753.
- 38 Lashkarboloki F, Aryaei M, Djazayeri A, et al. Association of demographic, socio-economic features and some health problems with nutritional status in elderly. *Iranian J Nutr Sci Food Technol.* 2015;9:27-34.
- 39 Eteraf Oskouei T, Vatankhah E, Najafi M. The status of potentially inappropriate medication prescription by general physicians for the elderly in Tabriz (Iran) according to Beers criteria. *Iranian J Ageing.* 2021;16:274-87.