

Dental health status of community-dwelling older adults and its relation to their nutritional status in northwest of Iran

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Background: Tooth status is one of the effective factors in incidence and prevalence of malnutrition in older adults. The present study aims to determine dental health status and its relationship with nutritional status of older adults.

Methods: The current study was a cross-sectional survey and its population was community-dwelling older adults in Tabriz, Iran. The representative sample included 1041 older adults (506 males and 535 females) selected by probability proportional to size sampling method. The condition of the teeth was determined by a questionnaire and the malnutrition status using mini nutritional assessment-short form and anthropometric indices.

Results: Of studied older adults, 4.3% were toothless, 68.4% toothless with complete prosthesis, 1.7% natural teeth but mostly decayed, 6.1% natural teeth and mostly healthy and 9.5% had a combination of natural teeth and prosthesis. The sum of malnutrition and at risk of malnutrition in the toothless older adults were 51.1%, toothless with complete prosthesis 28.9%, natural teeth but mostly decayed 27.30%, natural teeth mostly healthy 23.8% and in the older adults with combination of natural teeth and prosthesis were 22.2%.

Conclusion: Older adults with combination of natural teeth and prosthesis had the lowest levels of malnutrition and at risk of malnutrition. The toothless had the highest levels of malnutrition, as more than half of them were malnourished or at risk of malnutrition. There was a significant relationship between dental status and nutritional status. However, there was no significant relationship between dental status and anthropometric indices (BMI, WC and WHpR).

Keywords: Older adults, Tooth loss, Nutritional status, Geriatric dentistry, Oral Health

Introduction

The number of older adults is increasing in Iran, as the world's population changes, and it is anticipated that Iran will experience a fast population aging in the coming decades^[1]. World Health

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Organization (WHO) has introduced older adults as one of the most vulnerable groups to malnutrition^[2]. Proper nutritional and psychological status improves the health status of older adults and reduces their mortality as well as their chance of illness^[3] and it is estimated that one quarter of all health problems of the older adults directly and indirectly relate to nutrition and inadequate fluid intake^[4]. A significant proportion of Iranian older adults are malnourished or at risk of malnutrition^[5]. Older adults suffering from malnutrition have longer disease duration and hospital stay, higher incidence of complications, infections and iatrogenic diseases, lower quality of life, and poor healing of wounds; resulting in higher mortality rate in these people^[6,7]. Aging is associated with changes such as oral and dental problems, food chewing and other common problems^[4,8]. These problems alone or in combination with other problems can lead to changes in nutritional status, loss of weight, and BMI^[4].

Changes in the condition of the teeth in the older adults can cause problems in chewing and swallowing and therefore can reduce the intake of some foods^[4,9]. Identifying these problems is an essential step towards improving health and the quality of life of the older adults.

Given that few studies have been conducted on the relationship between dental health and nutrition status and anthropometric indices in the world and Iran, the present study was aimed to determine the dental health status of community-dwelling older adults and its relation to their nutritional status in Tabriz.

Materials and methods

Study setting

East Azerbaijan Province is located in northwest of Iran. Tabriz, the capital city of the province, is the largest economic hub, and the most populated city in north-west of Iran. The city is located in a cold and semi-arid climate zone. Almost all the population of the city is Iranian Azerbaijanis and the most spoken language in the city is Azeri Turkish. According to the official census data, the total population of 60 years and older was about 174000 (more than 11% of the city's population) over the present study period.

Study population

The current study is a descriptive cross-sectional survey in which the statistical population included all the people aging 60 years and older living freely in Tabriz city.

Sample size and sampling method

According to the Statistical Center of Iran, the population of interest totaled about 174000. Individuals who were older than 60 years were included in the study. Based on Cochran's sample size formula by assuming $p=0.5$ (maximum variability), $d=0.03$ and significance level= 0.95 , sample size was estimated to be 1,067 participants in the original study^[10], anthropometric measurements were available in 1041 cases (506 males and 535 females). Participants were selected by using Probability Proportional to Size (PPS) sampling method. It is a sampling procedure under which the probability of a unit being selected is proportional to the size of the ultimate unit, giving larger clusters or blocks a greater probability of being selected and smaller clusters or blocks a lower probability^[11]. At the first stage and in order to ensure that all units in the population have the same probability of selection irrespective of the size of their cluster, 107 blocks were selected out of 8531 urban blocks of Tabriz. After calculating the sampling interval by dividing the total population by the number of blocks, the random starting point (first block) was picked up in a range between 1 and the sampling interval using random number table. Then the consecutive blocks were determined utilizing randomized systematic sampling process. At the next stage, 10 older adults were randomly nominated from each block in a way that all eligible people of each building were selected and included in current study. Community-dwelling older adults were considered ineligible if they had multiple chronic difficulties or severe cognitive impairment or were too frail to undertake the survey.

Demographic information

Studied demographic variables included age and gender. Participants were categorized in three main age groups including 60-69, 70-79, and 80 years and older.

Data collection tools

Data collection instrument was a questionnaire that included demographic information and Mini Nutritional Assessment-Short Form (MNA-SF) questionnaire. Several tools are available for nutritional screening and risk assessment in older adults^[12]. Among the assessed instruments, MNA-SF is one of the most appropriate nutritional screening tools^[13]. Based on a review study, MNA-SF is the most appropriate nutritional screening tool to identify the risk of malnutrition in the community-dwelling older adults^[14]. Mini Nutritional Assessment-Short Form, as a tool that is used lonely for

nutrition screening, has been validated^[15]. The instrument consists of 6 questions, including two anthropometric parameters (body mass index and recent weight loss), a diet parameter (food intake), a general assessment parameter (mobility) and two health assessment items (psychological stress or acute diseases and Neuropsychological problems)^[16,17]. The maximum score of MNA-SF is 14^[18] and based on its total points, the nutritional status of the population is classified into three categories. 12-14 scores indicate normal nutritional status; 8-11 scores show risk of malnutrition and 0-7 scores indicate malnutrition status (malnourished)^[19]. Based on an evaluation carried out in Iran, MNA-SF has remarkable agreement with the full MNA and seems to be an appropriate screening instrument for rapid detection of malnutrition or risk of malnutrition in community-dwelling older adults^[20].

Dental status of the older adults, based on opinion of relevant specialists, was classified in toothless, with natural teeth and prosthesis, with natural teeth but mostly decayed, with natural teeth and mostly healthy, and toothless with complete prosthesis groups.

Anthropometric instruments and conditions

The instruments used included Seca portable digital scale (Seca, Hamburg, Germany) with precision of 100 g and Seca inelastic measuring tape and stadiometer with precision of 0.5 cm, by which the weight (kg), waist circumference (WC) (cm), hip circumference (HC) (cm), and height (cm) of the individuals were measured. The participants were weighed while wearing light clothes and without shoes. Measuring the WC was performed at the point recommended by WHO, i.e., the midpoint between the last rib and the iliac crest (the smallest WC)^[21] HC at the most protuberant area (the highest HC value) was measured by a measuring tape. These anthropometric measurements were performed at the participants' living places. Body mass index (BMI) and waist-to-hip ratio (WHpR) were calculated by dividing the values of weight (kg) by square of height (m²) and dividing the WC by HC, respectively.

Data collection and data analysis

Data collection was performed by trained Nutrition experts through measuring weight, height, WC, and HC of the individuals. In case of not accessing the subject at the relevant identified address, the alternative sample was replaced from the next household at the right side. In order to analyze the obtained data, the descriptive and inferential statistical methods were used in the framework of SPSS software.

Results

The gender ratio, the mean age, and the mean of anthropometric indices, including weight, height, BMI, WC, HC, and WHpR of the studied people in present study are presented in Table 1, by sex. In the present study, 48.56% of the subjects were male and 51.44% female. The mean age of the older adults was 69.96 ± 8.1 years. The mean weight of the subjects was 71.7 ± 13.7 (Kg) and mean height was 159.1 ± 10.1 cm. The average weight and height of men were higher than women. The mean BMI in the subjects was 28.4 ± 5.4 (26.8 ± 4.2 men and 29.9 ± 6.0 kg/m² women). The waist circumference and hip circumference of the subjects were 101.0 ± 14.0 and 104.8 ± 12.6 cm, respectively. Dental status of the studied older adults has been presented in Figure 1. Nutritional status of the studied people based on MNA-SF score has been presented in Figure 2.

Table 1

Demographic characteristics of community-dwelling older adults.

Anthropometrics (mean ± SD)	Gender		p-value ¹	Total (1041)
	Female (506)	Male (535)		
Age(year)	71.1 ± 8.3	68.9 ± 7.9	<0.001	69.96 ± 8.1
Weight (kg)	73.9 ± 12.6	69.7 ± 14.4	<0.001	71.7 ± 13.7
Height (cm)	165.9 ± 7.7	152.6 ± 7.5	<0.001	159.0 ± 10.1
BMI (kg/m ²)	26.8 ± 4.2	29.9 ± 6.0	<0.001	28.4 ± 5.4
WC (cm)	99.7 ± 13.6	102.3 ± 14.3	0.004	101.0 ± 14.0
HC (cm)	101.6 ± 10.7	107.7 ± 13.4	<0.001	104.8 ± 12.6
WHpR	0.98 ± 0.08	0.95 ± 0.07	<0.001	0.97 ± 0.08

BMI: Body Mass Index, HC: Hip Circumference, WC: Waist circumference, WHpR: Waist to Hip Ratio

¹Independent Samples Test

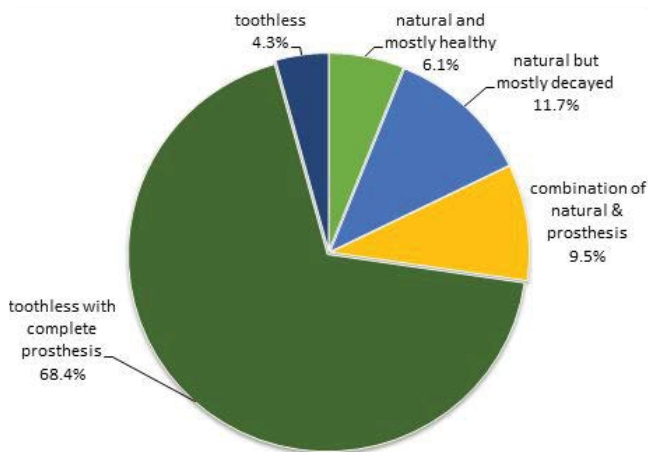


Figure 1. Dental health status of older adults in Tabriz.

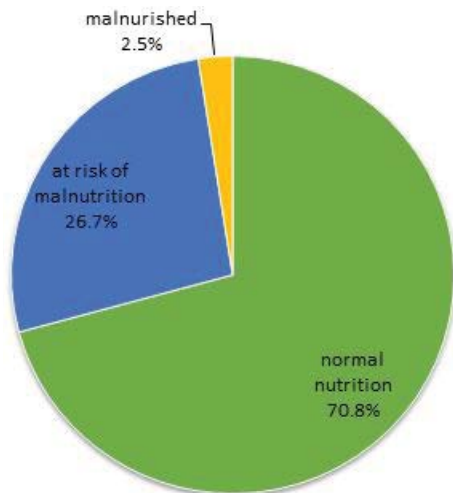


Figure 2. Nutritional status of Tabriz older adults.

Anthropometric indicators

The results of anthropometric indices (BMI, WC and WHpR) are presented in Table 1. According to the results of current study, the mean BMI of the older adults (male and female) was in the range of 25-29.9, although it is higher in women than in men. The average WC for both men and women was more than the recommended maximum levels for the Iranians (95 cm). The average WC was higher in women than in men, as was the BMI. The mean WHpR

in men was higher than women and was higher than the maximum recommended levels (9.0 for men and 0.85 for women) in both genders.

Dental health-Nutritional status

Nutritional status (Suffering from malnutrition, at risk of malnutrition and normal nutrition) of studied older adults in terms of the dental status (toothless, toothless with complete prosthesis, with natural teeth but mostly decayed, with natural teeth and mostly healthy, and combination of natural teeth and dental prosthesis) has been presented in Table 2. Total of malnutrition and at risk of malnutrition in the toothless older adults was 51.1%, toothless with complete prosthesis 28.9%, with natural teeth but mostly decayed 27.30%, with natural teeth and mostly healthy 23.8%, and in the older adults with combination of natural teeth and dental prosthesis 22.2%.

Table 3 shows the relationship between dental status and anthropometric indices (BMI, WC and WHpR) in the older adults studied in present survey. The results indicate no significant difference in terms of dental status.

Discussion

Dental status

In the present study, about two thirds of the older adults had complete prosthesis. In the study of Ebrahimi et al., about one-tenth of the older adults had a combination of natural teeth and dentures, and another one-tenth of them had natural teeth but mostly decayed, whereas the number of toothless and with natural teeth and mostly healthy older adults was so much lower. In the study of Biranvand et al. in the older adults of Ilam province, 45.5% of the subjects used dentures^[22].

Nutritional status

MNA-SF score: Based on the findings of the present study, according to the MNA-SF, although the prevalence of malnutrition in the older adults is low, but a significant percentage (about one quarter) of them is at risk of malnutrition. Most of the older adults (about two third) had normal nutrition.

Anthropometric Indices: According to the findings of the present study, based on the mean BMI, the studied subjects had overweight, both male and female, and it was higher in women

Table 2

Teeth status among community-dwelling older adults according to their nutritional status.

Teeth status	Nutritional status				p-value ¹
	Malnourished n (%)	At risk n (%)	Normal n (%)	Total n (%)	
Toothless	1(2.2)	22(48.9)	22(48.9)	45(4.3)	0.028
Toothless with complete prosthesis	19(2.7)	186(26.2)	506(71.2)	711(68.4)	
Natural teeth but mostly decayed	4(3.30)	29(24.0)	88(72.7)	121(11.7)	
Natural teeth and mostly healthy	1(1.6)	14(22.2)	48(76.2)	63(6.1)	
Combination of natural teeth and prosthesis	0(0.0)	22(22.2)	77(77.8)	99(9.5)	

Nutritional status was assessed using MNA-SF

¹Chi-square test**Table 3**

Anthropometric measurements among community-dwelling older adults according to their teeth status.

Teeth status	Anthropometric measurements					
	BMI (Mean ± SD)	p-value ¹	WC (Mean ± SD)	p-value ¹	WHpR (Mean ± SD)	p-value ¹
Toothless	27.78 ± 5.49	0.546	101.63 ± 12.92	0.924	0.97 ± 0.069	0.592
Toothless with complete prosthesis	28.30 ± 5.39		100.89 ± 13.97		0.97 ± 0.079	
Natural teeth but mostly decayed	28.96 ± 5.93		100.61 ± 14.58		0.97 ± 0.071	
Natural teeth and mostly healthy	28.38 ± 4.40		101.84 ± 14.08		0.96 ± 0.011	
Combination of natural teeth and prosthesis	29.08 ± 5.41		101.85 ± 14.04		0.95 ± 0.072	

BMI: Body Mass Index, HC: Hip Circumference, WC: Waist Circumference, WHpR: Waist to Hip Ratio

¹Analysis of Variance (One-way ANOVA)

than in men. Based on the average WC and its comparison with the recommended cut-off points for Iranians, both sexes suffered from abdominal obesity and, of course, women more than men. According to the WHpR mean, both sexes were obese, but in men obesity was more prevalent than women, which can be due to the higher hip circumference in women than men. In the present study, the anthropometric indices of obesity (mean BMI, WC and WHpR) were significantly higher than those of Ebrahimi et al., which seems to be due to the increasing trend of overweight and obesity over time in societies. Comparing the results of the present study with the results of studies in Hamedan^[23], Tehran^[24], Urumia^[25] and Birjand^[26] show that the mean BMI of the older adults and the prevalence of overweight and obesity in the older adults of Tabriz were higher than the older adults of the mentioned cities of Iran.

Dental health - Nutritional status

Dental Status and Results of MNA-SF: The findings of present study on community-dwelling older adults in Tabriz indicate that sum of malnutrition and at risk of malnutrition (based on MNA-SF score) had a decreasing trend from toothless older adults to toothless with complete prosthesis, natural teeth but mostly decayed, natural teeth and mostly healthy, and older adults with a combination of natural teeth and dentures. In other words, the sum of malnutrition

and at risk of malnutrition were higher in older adults with natural teeth or with more natural teeth than those were toothless, or dentures or less natural teeth, and there was a significant relationship between the dental condition and the nutritional status according to MNA-SF score. In studies, significant relationship has been reported between oral and dental diseases and malnutrition and weight loss in the older adults^[27]. In the study of Salehi et al. in Zahedan, the most important obstacles to lack of adequate consumption of fruits and vegetables were lack of knowledge, economic problems and oral and dental problems^[28]. The study of Lashkarbluki et al. in Gorgan and also the study of Pasdar et al. in Kermanshah showed a significant relationship between dental problems and food chewing with malnutrition^[29,30]. In the study of Pasdar et al., older adults with dental problems, food chewing and swallowing problems got lower MNA score than others, so that there was an inverse relationship between the number of dental problems and the MNA score^[30]; but in the study of Ebrahimi et al., there was not any relationship between dental status and energy and macronutrients intake^[31]. A study by Marcenes et al. found that older adults with more healthy teeth and more chewing ability were able to use all food groups and had a better nutritional status and a more appropriate BMI^[32]. The study by Nowjack et al. found that older adults with dentures had more improper nutritional status than older adults with natural

healthy teeth^[33]. The changes in the condition and the number of teeth in the older adults affect the nutritional status and pattern of food intake and ultimately affect the physical health^[29]. In fact, problems with the mouth and teeth can cause problems of chewing and swallowing that in turn reduces the intake of some of foods^[34].

Dental Condition and Anthropometric Indicators: The findings of present study on community-dwelling older adults indicate that there is no relationship between dental status and anthropometric indices (BMI, WC and WHpR). In the study of Ebrahimi et al., there was no association between dental status with anthropometric indices (BMI, WC and WHpR)^[31]. Kashiwazaki et al. study did not show any relationship between chewing power, dental status and BMI in the older adults^[35], but in the study of Sheilham et al., the older adults with a higher number of teeth had higher BMI than toothless older adults or older adults with a lower number of teeth^[34]. It seems that the reason for the lack of relationship between BMI and dental condition in the older adults can be due to the consumption of soft foods that do not require full dental chewing and the habit of using gum for eating for a long time, which can prevent weight loss and, consequently, not reducing BMI in the older adults^[35,36]. There is a limited study on central obesity indicators and dental status, however, given that there was a significant relationship between BMI and WC in Santos and Sichier et al., studies^[21,37] and WC and WHpR are used as indicators of abdominal obesity in the population^[37], it seems that we can generalize the relationship between BMI and dental status to WC and WHpR.

Conclusion

In general, the findings of present study indicate that, unlike anthropometric indices that are not related to the condition of the teeth, the nutritional status of the older adults is related to the condition of their teeth, as by improving the status of the teeth, the status of malnutrition get better. Therefore, according to the results of the present study, the following suggestions are proposed:

- Correction and improvement of the condition of older adults' teeth, in order to prevent malnutrition and having self-esteem
- Further studies on the relationship between dental status and anthropometric indices, due to the lack of relationship between tooth status and anthropometric indices in present study

Ethical approval

This study was reviewed and approved by deputy of research ethics committee of Tabriz University of Medical Science (Ethical ID: IR.TBZMED.REC.1392.243). Informed consent was obtained from all participants and they were assured about confidentiality of personal information.

Competing interests

Authors declare no conflict of interest in the present study.

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- People who involved in conducting the survey (anthropometry measurements, questioning, etc).

References

1. Azizi ZA, Amini A, Tabrizi JS. Consequences of population aging in Iran with emphasis on its increasing challenges on the health system (Literature Review) *Depiction of Health*. 2015;6(1):54-64.
2. World Health Organization. Active ageing: A policy framework. *The Aging Male*. 2002;5(1):1-37.
3. Payahoo L, Khaje-bishak Y, Gargari BP, et al. Nutritional status and its relation with depression in free-living elderly individuals. *Medical Journal of Tabriz University of Medical Sciences & Health Services*. 2013;35(5).
4. Mamaghani EM, Vaziri Y, Mahdavi R. Dental health and its relation to macronutrient intake and anthropometric indices in "Khuban" private nursing home residents in Tabriz. *Medical Journal of Tabriz University of Medical Sciences*. 2007;29(3):21-27.
5. Azizi Zeinalhajlou A, Matlabi H, Sahebigh MH, et al. Nutritional status of the community-dwelling elderly in Tabriz, Iran. *Elderly Health Journal*. 2017;3(2):80-86.
6. Eshagi SR, Babak A, Manzori L, et al. The nutritional status of the elderly and their associated factors in Isfahan. *Iranian J Ageing*. 2007;2(3):340-345.
7. Ghorbani A, Karimzadeh T, Azadmanesh Y. Nutritional assessment in elderly hospitalized patients in Qazvin Teaching Hospitals in 2011. *Iranian Journal of Ageing*. 2013;8(1):33-40.
8. Afkhami A, Keshavarz SA, Rahimi A, et al. Nutritional status and associated non-dietary factors in the elderly living in nursing homes of Tehran and Shemiranat, 2004. *Payesh*. 2008;7(3):211-217.
9. Modanloo MM, Khosravez H, Ghobadee Kh, et al. Dental health status in elderly (Gorgan -Iran). *Journal of Gorgan University of Medical Sciences*. 2010;12(3):68-73.
10. Ghaffari S, Pourafkari L, Tajlil A, et al. The prevalence, awareness and control rate of hypertension among elderly in northwest of Iran. *J Cardiovasc Thorac Res*. 2016;8(4):76-82.
11. Lavrakas PJ. *Encyclopedia of survey research methods*: Sage Publications; 2008.
12. Gutiérrez-Gómez T, Cortés E, Palazón-Bru A, et al. Six simple questions to detect malnutrition or malnutrition risk in elderly women. *Peer J*. 2015;3:e1316.
13. Phillips MB, Foley AL, Barnard R, et al. Nutritional screening in community-dwelling older adults: A systematic literature review. *Asia Pac J Clin Nutr*. 2010;19(3):440-449.
14. Hamirudin AH, Charlton K, Walton K. Outcomes related to nutrition screening in community living older adults: A systematic literature review. *Arch Gerontol Geriatr*. 2016;62:9-25.
15. Kaiser MJ, Bauer JM, Ramsch C, et al. Validation of the Mini Nutritional Assessment short-form (MNA®-SF): A practical tool for identification of nutritional status. *JNHA*. 2009;13(9):782.
16. Calvo I, Olivar J, Martínez E, et al. MNA® Mini Nutritional Assessment as a nutritional screening tool for hospitalized older adults; rationales and feasibility. *Nutrición Hospitalaria*. 2012;27(5):7.
17. De Luis D, López Mongil R, González Sagrado M, et al. Evaluation of the mini-nutritional assessment short-form (MNA-SF) among institutionalized older patients in Spain. *Nutr Hosp*. 2011;26(6):1350-1354.
18. Nykänen I, Lönnroos E, Kautiainen H, et al. Nutritional screening in a population-based cohort of community-dwelling older people. *Eur J Public Health*. 2013;23(3):405-409.

19. Anil C M, Jomy J, Athira S, et al. The validity of Mini Nutritional Assessment Short-Form (MNA-SF) questionnaire in screening malnutrition among elderly aged 60 years and above in urban Coimbatore. *Asian Pac J Health Sci.* 2015;2(3):4.
20. Malek Mahdavi A, Mahdavi R, Lotfipour M, et al. Evaluation of the Iranian Mini Nutritional Assessment Short-Form in Community-dwelling Elderly. *Health Promot Perspect.* 2015;5(2):98-103.
21. Santos DMD, Sichieri R. Body mass index and measures of adiposity among elderly adults. *Rev Saude Publ.* 2005;39(2):163-168.
22. Beiranvand R, Shokoohi S, Babanejad M, et al. Study of health and disease status in elderly people of Ilam Province. *SJIMU.* 2013;21(6):276-286.
23. Jamshidi L, Seif A. Comparison of cardiovascular diseases risk factors in male and female older adults of Hamadan City, 2014. *J Gerontol.* 2016;1(1):1-10.
24. Shamsi A, Ebadi A. Risk factors of cardiovascular diseases in elderly people. *IJCCN.* 2011;3(4):189-194.
25. Asefi M, Asadi Shorkand A, Tizfah Ghavi T. Survey of prevalence of obesity in over 60 years old elderly in Urmia city. In: Asefi M, editor. Iranian's 5th national congress on prevention and treatment of obesity; Tehran. 2015;202.
26. Tyuri A, Yari E, Beheshti D, et al. prevalence of overweight, obesity and abdominal obesity in elderly in Birjand city in 2014. In: Tyuri A, editor. Iranian's 5th National Congress on Prevention and Treatment of Obesity, Tehran. 2015.
27. Andersson P, Westergren A, Karlsson S, et al. Oral health and nutritional status in a group of geriatric rehabilitation patients. *Scand J Caring Sci.* 2002;16(3):311-318.
28. Salehi S, Naji SA, Sargazi M. The amount of consumption of fruits and vegetables and related factors in the hospitalized elderly in Zahedan in 1389. *Iran J Ageing.* 2012;6(4):30-36.
29. 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 Nutri Sci.* 2015;9(4):27-34.
30. Pasdar Y, Gharetapeh A, Pashaie T, et al. Nutritional status using multidimensional assessment in Iranian elderly. *J Kermanshah Univ Med Sci.* 2011;15(3).
31. Dorner TE, Rieder A. Obesity paradox in elderly patients with cardiovascular diseases. *Int J Cardiol.* 2012;155(1):56-65.
32. Marcenes W, Steele JG, Sheiham A, et al. The relationship between dental status, food selection, nutrient intake, nutritional status, and body mass index in older people. *Cadernos de Saúde Pública.* 2003;19:809-815.
33. Nowjack-Raymer R, Sheiham A. Association of edentulism and diet and nutrition in US adults. *J Dent Res.* 2003;82(2):123-126.
34. Sheiham A, Steele JG, Marcenes W, et al. The relationship between oral health status and Body Mass Index among older people: a national survey of older people in Great Britain. *Br Dent J.* 2002;192(12):703-706.
35. Kashiwazaki H, Tei K, Takashi N, et al. Relationship between bite force and body mass index in the institutionalized elderly. *Geriatr Gerontol Int.* 2005;5(2):89-93.
36. Hutton B, Feine J, Morais J. Is there an association between edentulism and nutritional state? *J Can Den Assoc.* 2002;68(3):182-187.
37. Taylor RW, Keil D, Gold EJ, et al. Body mass index, waist girth, and waist-to-hip ratio as indexes of total and regional adiposity in women: evaluation using receiver operating characteristic curves. *The Am J Clin Nutr.* 1998;67(1):44-49.