# Malnutrition, Prevalence and Relation to Some Risk Factors among Elderly Residents of Nursing Homes in Tehran, Iran

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### Abstract

**Background:** Malnutrition and dehydration are two most common types of ailments residents of nursing homes (NH) prone to. It is very important to assess these problems because they can predispose the residents to severe illnesses. The aim of this study was to gather information on nutritional status and its associated risk factors in elderly residents of NHs in Tehran, Iran.

**Methods:** From 16 NHs in Tehran, 263 residents were randomly selected. Data were collected via questionnaires, including demographic characteristics, past medical history, present health problems and daily routines. The MNA questionnaire was used to gather information regarding their nutritional status.

**Results:** The present study showed that 10.3% of the elderly residents in nursing homes were malnourished. 66.4% of males and 70.8% of females were at risk of malnutrition. Multivariate analysis showed that after adjusting for confounders the following elderly-related factors were the independent risk factors of malnutrition: consuming half or less than of the food (OR=8.0, 95%CI=3.7-17.7), having no teeth or good prosthesis (OR=1.7, 95%CI=1.1-2.7), diabetes (OR=1.6, 95%CI=1.1-2.4), smoking (OR=0.6, 95%CI=0.3-1.2), studying (OR=0.4 95%CI=0.2-0.9) and praying in their free time (OR=1.8 95%CI=1.2-2.6).

**Conclusion:** The subjects' health-related factors and their free-time activities and nutritional behavior are the most important factors associated with poor nutrition among elderly residents of NHs; however, further investigation is needed to clarify the role of other factors in maintaining a suitable nutritional plan for them.

**Keywords:** Malnutrition, Elderly, Mini Nutritional Assessment (MNA), Nursing homes, Iran

## Introduction

Malnutrition is a state of deficiency, imbalance or excess of energy, protein and other nutrients having adverse effects on the form or function of the body and clinical outcome (1). Elderly residents in nursing homes are at an increased risk of malnutrition due to a variety of factors including sensory

loss, chewing and swallowing problems, a decrease in or loss of appetite, mobility restrictions, cognitive impairment, depressed mood and acute or chronic diseases demanding the use of multiple medications (2). As a vicious cycle this inadequate dietary intake and malnutrition contributes not only to the progression of already existing chronic diseases such as CVD, osteoporosis or mental disorders but can also predispose the subject to various acute health problems such as infection or dehydration (3). Moreover, patients with dementia often suffer from malnutrition, decreasing their functional capabilities even further (4). Among demented elderly, early in the course of the disease, impaired cognition negatively affects the amount of food intake (5, 6). With advanced dementia behavioral disturbances such as aversive eating behavior, restlessness and depression may cause weight loss (7).

As stated, malnutrition, low body mass index (BMI) and unintentional weight loss are risk factors for mortality and have a negative influence on the functional status and psychosocial well-being of the elderly population (8-10). The research of Otero UB et al. in Brazil investigating the mortality associated with malnutrition among the elderly shed light to the importance of this matter and the crucial need to pay more attention to this population and intervene whenever necessary (11).

The prevalence of malnutrition reported in the residents of the nursing homes has a wide range among different populations. One reason might be the lack of extended researches regarding nutritional deficiencies in nursing homes. Another reason might be the fact that malnutrition in this vulnerable population can easily be neglected by the nurses and other staff (12). In Sweden, one-third of the elderly residents living in some kind of nursing homes were malnourished (13).

About this problem, Iran is of no exception. Several investigations regarding nutritional status in nursing homes in Iran have demonstrated the same results, that malnutrition is a serious problem in nursing homes, demanding special attention. Although, Iran still has a relatively young population, the proportion of elderly is projected to double in less than 20 years and population

ageing is expected to be experienced in our country, therefore it is important to consider and address the needs and concerns of this group, which might have direct impacts on their well-being and quality of life.

In Isfahan, 56% of women and 58% of men had BMIs of less than 20. The main reasons were inadequate nutrient consumption, anorexia induced mental disorder and poor quality of food (14).

Study in 7 private nursing homes of Tehran showed insufficiency in the amount of nutrients such as calcium, iron, zinc, riboflavin, folate and vitamin B12 among the elderly residents, and also energy shortage was found in 47% of the total study population (15).

The aim of this study was to gather information on nutritional status and its associated risk factors in elderly residents of NHs in Tehran, Iran.

## Materials and Methods

Through a stratified random sampling from 44 public and private nursing homes in Tehran, 17 nursing homes were selected and 263 elderly residents were chosen as the study population. The inclusion criteria comprised of three main factors: being aged 60 years or older, living in a nursing home in Tehran, signing an informed consent about participating in the survey. Exclusion criteria included: being expired during the study, disapproving with participation in the study.

Data on the subjects' demographic characteristics and nutritional and health status were gathered during 2010 to 2012. Demographic characteristics included gender, educational level, marital status, birth place, previous job, number of children, the number of visits per month, who visited elderly the most in a month, things brought for elderly, exposure to sunlight, the way elderly spent his/her time in the nursing home, smoking status, supplementation use by elderly, being on a special diet, chronic diseases such as blood pressure, renal or digestive problems and coronary heart disease, dental health, sleeping hours during day or night, satisfaction with the food quality, food consumption status, satisfaction with the personnel.

To assess the risk of malnutrition in the subjects we used the Mini Nutritional Assessment (MNA) tool. It was developed to evaluate the risk of malnutrition in the elderly residents of nursing homes, hospitals and home care programs; since it included the physical and mental aspects of health and life (16).

The MNA has been an extensively used method to identify risk of malnutrition in the elderly (17, 18). Using this scoring system allowed us to screen the elderly with an adequate nutritional status, elderly at risk of malnutrition and those who are malnourished. This method is a simple, low cost and non-invasive method that can be utilized at bedside. The MNA questionnaire consists of anthropometric and global indicators including information on eating patterns and self-perception of health in elderly such as reduced food intake, weight loss of more than 3 kilograms, mobility, bed- or chair-bound, psychological stress, neuro-psychological problems, body mass index, inability to live independently, taking more than 3 prescription drugs, having skin ulcers or pressure sores, number of full meals eaten per day, the amount of high-protein foods consumed per day, consumption of fruits and vegetables, the amount of liquids drank per day, inability and difficulty in self-feeding, self-perception of nutritional status, self-perception of health status, mid-arm circumference of less than 21 centimetres and calf circumference of less than 31 centimetres (17).

Moreover, it is very important that (MNA) detects risk of malnutrition at a time which albumin levels and BMI are still normal (19). In the original MNA version, BMI (Body Mass Index) in weight/height$^2$ is included in the assessment.

The MNA score used in our survey consists of four parts: anthropometric measurements, general status, dietary information and subjective assessment (17). A score of less than 17 out of a maximum of 30 is regarded as an indication of malnutrition, 17 to 23.5 indicates a risk for malnutrition and scores greater than 23.5 indicates that the person is well nourished (17).

The BMI was calculated as weight (kg)/height$^2$ (m$^2$). Weight was measured in light clothing, with a floor scale. Standing height, mid arm circumference (MAC) and calf circumference (CCs) measured with a plastic tape measure at the widest part of the undressed calf. Mid arm circumference (MAC) was measured at the midpoint of the relaxed, non-dominant arm between the tip of the acromion and the olecranon process (20).

Height was measured with a ruler in upright standing position without shoes. In elderly unable to stand in a straight upright position, Demispan formula was used to estimate the actual height. This method is recommended by the Mini Nutritional Assessment tool, and requires no specialized equipment. Demispan was measured as the distance from the middle of the sternal notch to the tip of the middle finger (preferably the left arm) with the arms of the elderly in a horizontal position and in line with his or her shoulders. Then the height of the person can be calculated via the following formulas (21):

Females:
Height in cm = 1.35 × demispan (cm) + 60.1
Males:
Height in cm = 1.40 × demispan (cm) + 57.8

### Statistical analysis

We entered the data in to SPSS (17.0) and analyzed it with this software and STATA (11.0). Univariate and then multivariate ordinal polytomous regression were employed to investigate the association between the malnutrition and its risk factors. As the nursing homes formed cluster in our sampling scheme, Complex Sample Survey (SVY) ordinal regression analysis was performed in STATA to account for data structure. In final model *P*-value of less than 0.05 was considered as significant.

## Results

Two hundred sixty three elderly from seventeen nursing homes in Tehran, Iran participated in this study during 2010 to 2012, consisting of 54.8% female and 45.2% male. The mean (±SD) age of study population was 75.9 (±8.5) years, of which 44.5% were aged 60 to 74 years old. Table 1 shows demographic and baseline characteristics of participants.

**Table 1:** Demographic characteristics of the study population according to nutritional status

| Demographic characteristics | | Nutritional status | | | Total n (%) | *P\** |
|---|---|---|---|---|---|---|
| | | Well nourished n (%) | At risk of malnutrition n (%) | Malnourished n (%) | | |
| Sex | Male | 32 (26.9) | 79 (66.4) | 8 (6.7) | 119 (45.2) | 0.04 |
| | Female | 23 (16.0) | 102 (70.8) | 19 (13.2) | 144 (54.8) | |
| Age groups | 60_74 yr | 28 (23.9) | 81 (69.2) | 8 (6.8) | 117 (44.5) | 0.10 |
| | 75_84 yr | 19 (19.2) | 68 (68.7) | 12 (12.1) | 99 (37.6) | |
| | ≥85 yr | 8 (17.0) | 32 (68.1) | 7 (14.9) | 47 (17.9) | |
| Marital status | Married | 36 (20.1) | 123 (68.7) | 20 (11.2) | 179 (68.1) | 0.44 |
| | Single | 8 (54.8) | 35 (76.1) | 3 (6.5) | 46 (17.5) | |
| | Divorced | 11 (29.0) | 23 (60.5) | 4 (10.5) | 38 (14.4) | |
| Education | Illiterate | 19 (16.7) | 81 (71.0) | 14 (11.3) | 114 (43.4) | 0.11 |
| | Primary or high school | 17 (21.3) | 54 (67.5) | 9 (11.2) | 80 (30.4) | |
| | Diploma or university | 19 (27.5) | 46 (66.7) | 4 (5.8) | 69 (26.2) | |
| Smoking (pack-year) | Non-smoker | 40 (18.8) | 149 (70.0) | 24 (11.2) | 213 (81.3) | 0.005 |
| | 0-19 | 7 (22.6) | 22 (71.0) | 2 (6.5) | 31 (11.8) | |
| | ≥20 | 8 (44.4) | 9 (50.0) | 1 (5.6) | 18 (6.9) | |
| Job | Worker | 1 (20.0) | 4 (80.0) | 0 (0.0) | 5 (4.4) | 0.51 |
| Male | Employee | 10 (33.3) | 20 (66.7) | 0 (0.0) | 30 (26.3) | |
| | Self-employed | 16 (23.9) | 45 (67.1) | 6 (9.0) | 67 (58.8) | |
| | Other | 4 (33.3) | 7 (58.4) | 1 (8.3) | 12 (10.5) | |
| Female | House wife | 21 (19.3) | 77 (70.6) | 11 (10.1) | 109 (76.8) | 0.01 |
| | Employed | 2 (6.1) | 24 (72.7) | 7 (21.2) | 33 (23.2) | |
| Diabetes | No | 49 (22.4) | 149 (68.0) | 21 (9.6) | 219 (83.3) | 0.008 |
| | Yes | 6 (13.6) | 32 (72.7) | 6 (13.6) | 44 (16.7) | |
| Hypertension | No | 45 (22.3) | 136 (67.3) | 21 (10.4) | 202 (77.1) | 0.31 |
| | Yes | 9 (15.0) | 45 (75.0) | 6 (10.0) | 60 (22.9) | |
| Renal disease | No | 52 (20.9) | 170 (68.3) | 27 (10.8) | 249 (96.1) | 0.87 |
| | Yes | 1 (10.0) | 9 (90.0) | 0 (0.0) | 10 (3.9) | |
| Digestive problems | No | 52 (21.0) | 170 (68.5) | 26 (10.5) | 248 (95.0) | 0.60 |
| | Yes | 2 (15.4) | 10 (76.9) | 1 (7.7) | 13 (5.0) | |
| Heart disease | No | 45 (21.4) | 145 (69.1) | 20 (9.5) | 210 (80.2) | 0.26 |
| | Yes | 9 (17.3) | 36 (69.2) | 7 (13.5) | 52 (19.8) | |
| Total | | 55 (20.9) | 181 (68.8) | 27 (10.3) | 263 (100) | |

**\*** SVY ordinal regression

Only 20.9% of the subjects were well nourished. Of the rest, 68.8% were at risk of malnutrition and 10.3% were categorized as malnourished. Sig-nificant risk of malnutrition or malnourishment was found among the following sub groups: Fe-males (73.1%), non-smokers (81.2%), those who

were dissatisfied with quality of food (92.6%) or nursing home's personnel (94.1%), subjects who ate half or less than half of their food (97.7%), those who were sleeping less than 6 hours (87.7%), elderly with less than 2 hours exposure to sunlight (81.5%) and diabetic subjects (86.4%) (P<0.05; Table 1 and 2).

According to univariate analysis on data, the probability of being at risk for malnutrition or malnourishment showed to be weakly higher (P=0.06) in elderly with no teeth or no good prosthesis (83.6%), subjects who did not watch TV or listen to radio (P=0.08; 83.9%) and those who said

their prayers (P=0.06; 91.9%). A significantly better nutritional status (P=0.008) was found among elderly who studied in their free time, however, those who used to speak or rest or pray or walked with other friends or helped them did not show a significant difference in nutritional status compared to others (P>0.05; Table 3).

To find the independent risk factors of malnutrition, the variables with P-values of less than 0.10 were analyzed by a multivariate SVY ordinal logistic regression model, performing a backward elimination procedure.

**Table 2:** Food intake, satisfaction with the personnel and food quality, depression status, and hours of sleep according to nutrition status

| Variables | | Nutritional status | | | Total n (%) | P |
|---|---|---|---|---|---|---|
| | | Well nourished n (%) | At risk of malnutrition n (%) | Malnourished n (%) | | |
| Having bad teeth | No | 42 (22.2) | 131 (69.3) | 16 (8.5) | 189 (72.1%) | 0.06 |
| | Yes | 12 (16.4) | 50 (68.5) | 11 (15.1) | 73 (27.9) | |
| Satisfied with food quality | No | 53 (22.5) | 160 (67.8) | 23 (9.7) | 236 (89.7) | 0.03 |
| | Yes | 2 (7.4) | 21 (77.8) | 4 (14.8) | 27 (10.3) | |
| Amount of food eaten | > Half of the food | 53 (24.3) | 151 (69.3) | 14 (6.4) | 218 (83.2) | <0.0001 |
| | ≤ Half of the food | 1 (2.3) | 30 (68.2) | 13 (29.5) | 44 (16.8) | |
| Satisfied with the personnel | No | 1 (5.9) | 12 (70.6) | 4 (23.5) | 17 (6.5) | 0.04 |
| | Yes | 54 (22.0) | 169 (68.7) | 23 (9.3) | 246 (93.5) | |
| Number of roommates | 0-6 | 37 (21.8) | 114 (67.0) | 19 (11.2) | 170 (65.6) | 0.91 |
| | 7-15 | 17 (19.1) | 64 (71.9) | 8 (9.0) | 89 (34.4) | |
| Taking supplement | No | 54 (21.3) | 172 (68.0) | 27 (10.7) | 253 (96.6) | 0.94 |
| | Yes | 1 (11.1) | 8 (88.9) | 0 (0.0) | 9 (3.4) | |
| Visitors Bringing them extra food | No | 14 (18.0) | 55 (70.5) | 9 (11.5) | 78 (30.0) | 0.33 |
| | Yes | 40 (22.0) | 124 (68.1) | 18 (9.9) | 182 (70.0) | |
| Depression | No | 6 (25.0) | 17 (70.8) | 1 (4.2) | 24 (10.1) | 0.11 |
| | Mild | 25 (20.8) | 87 (72.5) | 8 (6.7) | 120 (50.6) | |
| | Moderate | 8 (11.6) | 50 (72.5) | 11 (15.9) | 69 (29.2) | |
| | Severe | 4 (16.7) | 16 (66.6) | 4 (16.7) | 24 (10.1) | |
| Hours of sleep | 0-5.9 | 8 (12.3) | 48 (73.8) | 9 (13.9) | 65 (24.7) | 0.009 |
| | 6-15.5 | 47 (23.7) | 133 (67.2) | 18 (18.1) | 198 (75.3) | |
| Total | | 55 (20.9) | 181 (68.8) | 27 (10.3) | 263 (100) | |

* SVY ordinal regression.

The result of this analysis is depicted in Table 4, showing that eating half or less than half of the food had an odds ratio (OR) of 8.0 with 95% confidence interval (CI) 3.7-17.7, and not having any teeth or a good prosthesis had a risk of 1.7 (95% CI: 1.1-2.7) in increasing the risk of malnutrition. Also, the diabetic subjects were significantly more prone to develop malnutrition (OR=1.6; 95% CI: 1.1-2.4). As opposed to praying risk was 1.8 (95% CI: 1.2-2.6) and studying in free time showed a protective effect on the level of the subject's malnutrition status. Although, smoking seemed to have a protective effect against developing higher levels of malnutrition, the smokers of more than 20 pack-year had odds ratio of 0.8 (95% CI: 0.5-0.9) in being at risk of malnourishment.

**Table 3:** Free time activity and the amount of sun light exposure of the study population according to nutrition status

| Variables | | Nutritional status | | | Total | *P* |
|---|---|---|---|---|---|---|
| | | Well nourished n (%) | At risk of malnutrition n (%) | Malnourished n (%) | n (%) | |
| Studied in their free time | No | 53 (20.9) | 174 (68.5) | 27 (10.6) | 254 (97.3) | 0.008 |
| | Yes | 2 (28.6) | 5 (71.4) | 0 (0.0) | 7 (2.7) | |
| Watched TV/listened to radio | No | 13 (16.1) | 58 (71.6) | 10 (12.3) | 81 (31.0) | 0.08 |
| | Yes | 42 (23.3) | 121 (67.2) | 17 (9.4) | 180 (69.0) | |
| Spoke with others | No | 12 (21.4) | 37 (66.3) | 7 (12.5) | 56 (21.5) | 0.80 |
| | Yes | 43 (21.0) | 142 (69.3) | 20 (9.7) | 205 (78.5) | |
| Prayed | No | 30 (24.4) | 83 (67.5) | 10 (8.1) | 123 (47.1) | 0.06 |
| | Yes | 25 (18.1) | 96 (69.6) | 17 (12.3) | 138 (52.9) | |
| Rested | No | 21 (19.4) | 75 (69.4) | 12 (11.2) | 108 (41.4) | 0.56 |
| | Yes | 34 (22.2) | 104 (68.0) | 15 (9.8) | 153 (58.6) | |
| Helped the others | No | 49 (21.4) | 166 (69.2) | 25 (10.4) | 240 (92.0) | 0.58 |
| | Yes | 6 (28.6) | 13 (61.9) | 2 (9.5) | 9 (8.0) | |
| Walked | No | 32 (23.0) | 94 (67.6) | 13 (9.4) | 139 (53.3) | 0.36 |
| | Yes | 23 (18.9) | 85 (69.7) | 14 (11.4) | 122 (46.7) | |
| Sun light exposure | 0 | 23 (19.2) | 81 (67.5) | 16 (13.3) | 120 (45.6) | 0.04 |
| | 0.1-2 hr | 20 (17.7) | 83 (73.4) | 10 (8.9) | 113 (43.0) | |
| | 2.1-4 hr | 11 (42.3) | 14 (53.9) | 1 (3.8) | 26 (9.9) | |
| | 4.1-7.5 hr | 1 (25.0) | 3 (75.0) | 0 (0.0) | 4 (1.5) | |
| Total | | 55 (20.9) | 181 (68.8) | 27 (10.3) | 263 (100) | |

**\*** SVY ordinal regression

**Table 4:** Independent risk factors of risk of malnutrition in study population

| Risk factor | | OR (95% CI) | *P*\* |
|---|---|---|---|
| Amount of food intake | > Half of the food | Referent | - |
| | ≤ Half of the food | 8.0 (3.7-17.7) | <0.0001 |
| Had teeth or good prosthesis | Yes | Referent | - |
| | No | 1.7 (1.1-2.7) | 0.020 |
| Diabetes | No | Referent | - |
| | Yes | 1.6 (1.1-2.4) | 0.025 |
| Smoking | Non-smoker | Referent | - |
| | 0-19 | 0.6 (0.3-1.2) | 0.146 |
| | ≥20 | 0.2 (0.1-0.5) | 0.001 |
| Studied in free time | No | Referent | - |
| | Yes | 0.4 (0.2-0.9) | 0.021 |
| Prayed in free time | No | Referent | - |
| | Yes | 1.8 (1.2-2.6) | 0.009 |

* SVY Multiple ordinal logistic regression

## Discussion

Malnutrition is associated with significantly increased morbidity and mortality in independently living elderly, as well as the residents of nursing homes and hospitalized patients (22). The primary purpose of this study was to determine the prevalence of different grades of malnutrition and related independent risk factors in elderly residents of nursing homes in Tehran, Iran.

Our study demonstrated that more than 50% of the subjects suffer from different grades of malnutrition, which is a common problem among elderly residents of nursing homes in Tehran. According to MNA, nearly 42.9% of the elderly were well nourished, 66.4% of male and 70.8% of female subjects were at risk of malnutrition (17-23.5 points), and 19.9% of the studied residents were malnourished (<17 points). Analysis showed that the amount of food consumption had an odds ratio of 8.0 (3.7-17.7), and having teeth or good prosthesis, an OR of 1.7 (1.1-2.7) in increasing the grade of malnutrition. However, diabetes had an OR of 1.6 (1.1-2.4), smoking an OR of 0.2 (0.1-0.5), studying in their free time an OR of 0.4 (0.2-0.9) and praying in their free time an OR of 1.8 (1.2-2.6) (Table 3).

In multiple ordinal logistic regression analysis, several independent risk factors such as the amount of food consumption, having good teeth or prosthesis, diabetes, smoking status, studying or praying in free time were related to malnutrition.

The results of our study, regarding the prevalence of malnutrition and its patient-related risk factors, are different from those of previous surveys. Our results showed that 55 (42.9%) subjects were well nourished and from the 181 (68.82%) subjects at risk of malnutrition, only 27 (10.27%) were malnourished, while several other researches demonstrated that in different nursing homes the proportion of the elderly population suffering from malnutrition varied from 15 to 71 percent and about 40 to 60 percent of the subjects at risk of malnutrition (23-26).

Therefore, it is of utmost importance to take measures to prevent the subjects at risk of malnutrition to actually become malnourished by for example improving their food quality and nutritional status.

In this survey, the results of multivariate analysis showed a correlation between malnutrition and the amount of food consumption, which was directly affected by the oral health of the elderly (*P* <0.0001) (Table 2).

Dentures play an important role in nutritional status of the subjects. The elderly wearing protective dentures compared to those who were edentulous but did not use dentures were less prone to malnutrition (27).

It is important to pay special attention to this matter: how does tooth loss or having bad prosthesis affect dietary intake of an elderly? Although the link between various nutrients' deficiencies and systematic diseases has been established, but relatively little survey has been conducted investigating the relation between oral condition and nutrition (28).

In three large studies in the United States and Europe, tooth loss was associated with worse dietary status. A study assessed the association between disease-related nutrients and foods with the number of teeth, and showed that edentulous participants compared to subjects with more or equal to 25 teeth, consumed fewer vegetables, less carotene and fiber, and consumed more cholesterol, saturated fat and calories in their diets (29).

The results regarding the amount of food consumed and the status of teeth and prosthesis in current survey was similar to a survey, among community–dwelling elderly in Italy (aged 70-75 years). They showed a close relation between dental status and food intake. It was identified that the use of dentures can help improve both nutrient intake of the elderly and the quality of their life (30). People with fewer than optimal number of teeth, or without dentures may face problems caused by avoiding certain foods (31). Elderly without dentures were found to avoid eating, had difficulty in chewing and majority of them changed their meal composition and method of cooking to facilitate chewing (32).

Results regarding the amount of sunlight exposure showed that the more sunlight an elderly is exposed to (0.1-2 hr to 4.1-7.5 hr), the lower the grade of malnutrition; that was similar to another

research investigating under-nutrition in nursing homes (33). The researchers pointed out some common nutritional deficiencies among residents of the nursing homes such as Vitamin D, Vitamin B12, and Zinc as well as dehydration. To prevent Vitamin D deficiency, the staff simply needed to encourage their residents to get more sunlight exposure. As for the Vitamin B12 deficiency basic injections or inhalations of Vitamin B12 could have increased the level of this vitamin to its normal range. Just like the other two, zinc also could have been replaced to prevent health problems due to its deficiency (33).

Finally, not knowing when they are thirsty, elderly are prone to the common problem of dehydration that can easily be prevented by the nurses and other staff of the nursing home by making "fluid rounds" to make sure that patients are consistently hydrated (34).

Chevalier S et al demonstrated that malnutrition can compromise the functional status of the elderly subject leading to their vulnerability that may have a negative effect on their nutrition (35, 36).

Smoking showed a protective effect against developing higher levels of malnutrition in this study. Possible explanation might be the effect of smoking on the gastrointestinal movements, preventing the elderly from developing constipation, thus helping them to consume more food. The results might also be explained by the antalgic effects of smoking, which can enhance their food consumption by improving the mood of the elderly. These results paved the way for future studies to inspect the possible explanations of this matter.

There were some limitations in this study regarding the time keeping of the subjects' activities. Recording this information needed much more human resources than the current manpower in hand, so the results might lack some degree of accuracy. Also keeping track of the amount of food brought for the subjects by their siblings was another problem in data gathering.

## Conclusion

When adjusted for confounders, a decrease to less than half of the food consumed by the elderly sub-

jects was directly associated with worsening their nutritional status. Moreover, having no teeth health or good prosthesis, diabetes and praying in the free time were found as other independent risk factors while studying in free time had a protective effect. These findings were predictable except for the protective effect of smoking on deterioration of nutritional status.

## Ethical considerations

The implementation of this project has been approved by the Medical Ethics Committee of Tehran University of Medical Sciences.

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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## References

1. Stratton RJ, Green CJ, Elia M (2003). *Disease-related malnutrition: an evidence-based approach to treatment.* 1st ed. CABI, United Stated, pp.:31-8.
2. MacIntosh C, Morley JE, Chapman IM (2000). The anorexia of aging. *Nutrition,* 16: 983-95.

3. Volkert D, Kreuel K, Heseker H, Stehle P (2004). Energy and nutrient intake of young-old, old-old and very-old elderly in Germany. *Eur J Clin Nutr,* 58: 1190-200.

4. Magri F, Borza A, del Vecchio S, Chytiris S, Cuzzoni G, Busconi L, Rebesco A,Ferrari E (2003). Nutritional assessment of demented patients: a descriptive study. *Aging Clin Exp Res,* 15: 148-53.

5. Barrett-Connor E, Edelstein SL, Corey-Bloom J,Wiederholt WC (1996). Weight loss precedes dementia in community-dwelling older adults. *J Am Geriatr Soc,* 44 (10): 1147-52.

6. Cronin-Stubbs D, Beckett LA, Scherr PA, Field TS, Chown MJ, Pilgrim DM, Bennett DA,Evans DA (1997). Weight loss in people with Alzheimer's disease: a prospective population based analysis. *BMJ,* 314:178-9.

7. Blandford G, Watkins L, Mulvihill M,Taylor B (1998). Assessing abnormal feeding behavior in dementia: a taxonomy and initial findings. *Research and practice in Alzheimer's disease.* 1th ed. New York, Springer Publishing Company, pp.: 47-64.

8. Takala JK, Mattila KJ,Ryynänen O-P (1994). Overweight, underweight and mortality among the aged. *Scand J Prim Health Care,* 12: 244-8.

9. Dey D, Rothenberg E, Sundh V, Bosaeus I,Steen B (2001). Body mass index, weight change and mortality in the elderly. A 15 y longitudinal population study of 70 y olds. *Eur J Clin Nutr,* 55: 482-92.

10. Crogan NL,Pasvogel A (2003). The influence of protein-calorie malnutrition on quality of life in nursing homes. *J Gerontol A Biol Sci Med Sci,* 58: 159-64.

11. Otero UB, Rozenfeld S, Gadelha AMJ,Carvalho MS (2002). Mortalidade por desnutrição em idosos, região Sudeste do Brasil, 1980-1997. *Rev Saude Publica,* 36: 141-8.

12. Abbasi AA, Rudman D (1993). Observations on the prevalence of protein-calorie und-ernutrition in VA nursing homes. *J Am Geriatr Soc,* 41:117-21.

13. Saletti A, Johansson L,Cederholm T (1999). Mini Nutritional Assessment in elderly subjects receiving home nursing care. *J Hum Nutr Diet,* 12: 381-7.

14. Dorosty AR (2007). Correlation of elderly nutritional status with cardio-vascular disease and diabetes. *Tehran Uni Med J,* 65(3): 68-71.

15. Ahrari M,Kimiagar M (1997). Food intake and Body Mass Index in the privately institutionalized elderly in Tehran. *Int J Vit Nutr Res,* 67: 41-6.

16. Wells JL, Dumbrell AC (2006). Nutrition and aging: assessment and treatment of compromised nutritional status in frail elderly patients. *Clin Interv Aging,* 1(1): 67-79.

17. Guigoz Y, Vellas B, Garry P, Vellas B, Albarede JL (1999). The Mini Nutritional Assessment (MNA) and its use in grading the nutritional state of elderly patients. *Nutrition,* 15 (2): 116-22

18. Ferreira L, Nascimento L, Marucci M (2008). Use of the mini nutritional assessment tool in elderly people from long-term institutions of southeast of Brazil. *J Nutr Health Aging,* 12: 213-7.

19. Guigoz Y, Vellas B (1999). The Mini Nutritional Assessment (MNA) for grading the nutritional state of elderly patients: presentation of the MNA, history and validation. *Nestle Nutr Workshop Ser Clin Perform Programme,* 1: 3-11

20. Volkert D, Pauly L, Stehle P, Sieber CC (2011). Prevalence of malnutrition in orally and tube-fed elderly nursing home residents in Germany and its relation to health complaints and dietary intake. *Gastroenterol Res Pract,* 2011: 247315.

21. Hickson M, Frost G (2003). A comparison of three methods for estimating height in the acutely ill elderly population. *J Human Nutri Diet,* 16: 13-20.

22. Hickson M (2006). Malnutrition and ageing. *Postgrad Med J,* 82 (963): 2–8.

23. Lauque S, Arnaud-Battandier F, Mansourian R, Guigoz Y, Paintin M, Nourhashemi F (2000). Protein-energy oral supplementation in malnourished nursing-home residents. A controlled trial. *Age Ageing,* 29: 51-6.

24. Gerber V, Krieg M, Cornuz J, Guigoz Y, Burckhardt P (2003). Nutritional status using the Mini Nutritional Assessment questionnaire and its relationship with bone quality in a population of institutionalized elderly women. *J Nutr Health Aging,* 7: 140-5.

25. Van Nes MC, Herrmann FR, Gold G, Michel JP, Rizzoli R (2001). Does the mini nutritional assessment predict hospitalization outcomes in older people? *Age Ageing,* 30: 221-6.

Available at:   http://ijph.tums.ac.ir

26. Christensson L, Unosson M, Ek A-C (2002). Evaluation of nutritional assessment techniques in elderly people newly admitted to municipal care. *Eur J Clin Nutr,* 56: 810-8.

27. Zainab S, Ismail NM, Norbanee TH, Ismail AR (2008). The prevalence of denture wearing and the impact on the oral health related quality of life among elderly in Kota Bharu, Kelantan. *Arch Orofac Sci*, 3 (1): 17-22.

28. Ritchie CS, Joshipura K, Hung H-C, Douglass CW (2002). Nutrition as a mediator in the relation between oral and systemic disease: associations between specific measures of adult oral health and nutrition outcomes. *Crit Rev Oral Biol Med,* 13: 291-300.

29. Joshipura KJ, Willett W, Douglass C (1996). The impact of edentulousness on food and nutrient intake. *J Am Dent Assoc,* 127: 459-67.

30. Appollonio I, Carabellese C, Frattola A, Trabucchi M (1997). Influence of dental status on dietary intake and survival in community-dwelling elderly subjects. *Age Ageing,* 26: 445-55.

31. Roessler DM (2003). Complete denture success for patients and dentists. *Int Dent J,* 53: 340-5.

32. Sheiham A, Steele JG, Marcenes W, Tsakos G, Finch S,Walls AW (2001). Prevalence of impacts of dental and oral disorders and their effects on eating among older people; a national survey in Great Britain. *Community Dent Oral Epidemiol,* 29: 195-203.

33. Morley JE,Thomas DR (1999). Anorexia and aging: pathophysiology. *Nutrition,* 15: 499-503.

34. Pauly L, Stehle P, Volkert D (2007). Nutritional situation of elderly nursing home residents. *Z Gerontol Geriatr*, 40(1): 3-12.

35. Inzitari M, Doets E, Bartali B, Benetou V, Di Bari M, Visser M (2011). Nutrition in the age-related disablement process. *J Nutr Health Aging,* 15(8): 599-604.

36. Chevalier S, Saoud F, Gray-Donald K,Morais JA (2008). The physical functional capacity of frail elderly persons undergoing ambulatory rehabilitation is related to their nutritional status. *J Nutr Health Aging,* 12: 721-6.