

PJN

ISSN 1680-5194

PAKISTAN JOURNAL OF
NUTRITION

ANSI*net*

308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Assessment of Nutritional Status of Hospitalized Elderly Patients in Makkah Governorate

Muhammad A. Elmadbouly and Amany M. Abd Elhafez
Department of Clinical Nutrition, Applied Medical Science College,
Umm Al-Qura University, Saudi Arabia

Abstract: A cross sectional study was conducted to assess the nutritional status of a sample of 102 recently hospitalized elderly patients in general hospitals at Makkah Governorate by using the Mini Nutritional Assessment (MNA) tool. Among the studied patients, 22.6% were classified as malnourished, 57.8% were at risk of malnutrition and 19.6% were as well nourished. Low body mass index, history of weight loss during the last 3 months, living independently, taking > 3 prescription of drugs per day and presence of neuropsychological problems were associated with malnutrition ($p < 0.05$). The elderly classified as malnourished and those at risk of malnutrition and well nourished differed significantly in all dietary assessment variables of the MNA score ($p < 0.05$). It is concluded that malnutrition is a common problem among older people. MNA test should be performed for elderly upon admission to hospitals and more attention need to be paid to this vulnerable group of people.

Key words: Elderly, nutrition status, MNA test

INTRODUCTION

In recent years, there has been a sharp increase in the number of older persons worldwide (Ibrahim *et al.*, 2005). The proportion of the population aged 60 and over, is also growing each year, by the year 2025, the world will host 1.2 billion people aged 60 and over and rising to 1.9 billion in 2050. Saudi Arabia like most countries in the world is facing the challenge of an ageing population. By 2050 the number of dependant adults in Saudi Arabia will equal the number of dependent children for the first time. This gives Saudi Arabia more time to plan, what is often called a 'demographic dividend' (UN World Population Prospects, 2008).

Many elderly have several disorders at the same time. The incidence of diseases increases with age (Joshi *et al.*, 2003). Deterioration of the nutritional status affects and is affected by disease, especially among the elderly (Kagansky *et al.*, 2005). Nutritional diagnosis and the identification of factors that contribute to this diagnosis are, therefore, essential but complex processes. This complexity is due to the occurrence of many changes, both physiological and pathological, which may be taken as inherent to the aging or disease process (Gariballa and Forster, 2007). A comprehensive tool specifically developed for use with elderly people is the Mini-Nutritional Assessment (MNA): this tool is designed for purposes of identifying the risk of malnutrition in the frail elderly and identifying those who may benefit from early intervention (Soini *et al.*, 2004). This study was

conducted to assess the nutritional status of a sample of recently hospitalized elderly patients in general hospitals in Makkah Governorate, Saudi Arabia by using MNA tool.

MATERIALS AND METHODS

Subjects: A cross-sectional study was conducted during the academic year (2011). The study included 102 elderly Patients of both genders (females = 40 and males = 62), hospitalized in two general hospitals in Makkah Governorate. Patients aged 60 or more years (Oliveira *et al.*, 2009). The lower age limit was chosen according to the National Policy for the elderly that classifies individuals aged 60 years or older as elderly (Oliveira *et al.*, 2009). Patients with cancer, end-stage renal disease or terminal illness and those receiving artificial enteral or parenteral nutrition were excluded.

Methods: Data of elderly patients were collected with a structured interview questionnaire that was divided into two parts: Socio-economic status questionnaire and (MNA) questionnaire.

The MNA was translated into Arabic and tested by a pilot study for its reliability among 15 hospitalized elderly patients. The MNA is composed of 18 items and divided into four sections: general, dietetic, subjective and anthropometric assessments.

The MNA score was used to classify patients as well-nourished (a score of 24-30 points), at risk for malnutrition (a score of 17-23.5 points), or malnourished (a score of <17) (Saeidlou *et al.*, 2011).

Anthropometric measurements: Anthropometric measurements included: weight, height, Body Mass Index (BMI), Mid-Arm Circumference (MAC) and Calf Circumference (CC). Weight was measured in kilograms to the nearest 0.1 kg with electronic weight scale. The standing height was recorded to the nearest 0.1 centimeter by using the stadiometer (Yalcin *et al.*, 2004). When the patient was unable to stand, his height was estimated from the arm span (Mahan and Escott-Stump, 2008), using the tap the distance from the mark on the midline at the sternal notch to the tip of the middle finger was measured which equals half the arm-span. Height is then calculated by doubling the half arm-span (Capderou *et al.*, 2011). BMI was calculated with the BMI formula ($\text{weight}/\text{height}^2$; kg/m^2) (Santos *et al.*, 2004). MAC was measured with a flexible but non-stretchable measuring tape and was recorded to the nearest 0.1 centimeter, it was measured midway between the lateral projection of the acromion process of the scapula and the inferior margin of the oleocranon process of the ulna (Santos *et al.*, 2004). CC was taken while the elderly was lying supine and the knee and ankle were bent to a right angle. The loop of the tape was moved up and down the calf to locate the largest diameter and the measurement was recorded to the nearest 0.1 cm (Alhamdan and Alsaif, 2011).

Statistical analysis: Statistical analysis was performed using the Statistical Package for Social Science (SPSS) version 16. Quantitative data are presented as mean and standard deviation. Qualitative data were expressed as percentages. For the quantitative variables, compliance with the normal distribution was assessed using the Kolmogorov-Smirnoff test, as appropriate. For comparing the groups, the chi-square test was used for qualitative variables and the ANOVA or Kruskal-Wallis test for quantitative variables. Spearman correlation coefficients were performed to study the relations between total MNA scores and the different variables. P value of less than 0.05 was considered to indicate statistical significance.

RESULTS

Using the MNA score (22.6%) of hospitalized elderly were classified as malnourished, (57.8%) at risk of malnutrition and (19.6%) as well nourished. The three groups differed significantly from each other in the mean

scores of the MNA subgroup questions ($p < 0.01$) (Table 1). Malnutrition and risk of malnutrition were observed more frequently in illiterate individuals ($p < 0.05$), (78.3%) of malnourished elderly took >3 prescription of drug per day and (47.8%) had neuropsychological problems ($p < 0.05$) (Table 2). Table 3 shows that malnourished patients had lower BMI and 60.9% of them complained of weight loss during the last 3 months ($p < 0.05$). In addition 65.2% of malnourished patients lived independently and (43.5%) perceived that they were malnourished and (78.3%) either felt themselves in a bad health status or did not know ($p < 0.05$) A part from daily consumption of dairy products, elderly patients differed significantly in all dietary assessment variables of the MNA score (Table 4). Results of spearman correlation indicated that there was positive correlation between the total MNA score and, body mass index, mid-arm circumference and weight loss during the past three months among the studied patients ($p < 0.05$), also there was positive correlations between the total MNA score and the different variables related to general, dietary and self assessment items of the MNA score ($p < 0.05$) (Table 5).

DISCUSSION

Assessment of nutritional status, as a part of screening protocols, is necessary to identify malnutrition, which is a potential cause or an aggravation of morbidity and mortality (Alhamdan and Alsaif, 2011).

Among the studied elderly, only 19.6% were classified as having an adequate nutritional status; 57.8% at risk of malnutrition and 22.6% were classified as malnourished, similar results were recorded by Volkert *et al.* (2011); Ferdous *et al.*, (2007), but, inconsistent results were reported by Saeidlou *et al.* (2011), who found that 49.06% of the studied elderly patients were malnourished, 38.68% were at risk and 12.26% were well nourished, however the previous study was conducted among nursing home residents who are more or less disabled and generally living in an institution because of their need of help or care, high prevalence rates of malnutrition could be expected more in this group of elderly. This speculation was confirmed in many of the studies that reported malnutrition is more than 40% (Saeidlou *et al.*, 2011). On the other hand a Mongolian study was conducted by Oyunkhand *et al.* (2011), who found that 4.8% of Mongolian elderly were

Table 1: Mean score of the MNA subgroup questions in the malnourished, at risk of malnutrition and well nourished groups of hospitalized elderly patients. SD: Standard Deviation

Assessment questions	M (n = 23)		RM (n = 59)		A (n = 20)		*p-value
	SD	Mean	SD	Mean	SD	Mean	
Anthropometric assessment	1.6	4.8	1.4	5.9	1.0	6.8	0.00
General assessment	1.8	4.4	1.5	5.9	1.0	6.9	0.00
Dietary assessment	1.8	3.8	1.3	6.6	0.8	8.3	0.00
Self assessment	1.1	1.2	0.9	0.9	0.4	3.2	0.00

*p-value according to MNA by Kruskal-Wallis test

Table 2: Nutrition status according to MNA score, demographic data and general assessment variables for hospitalized elderly patients

Demographic data	M (n = 23)		RM (n = 59)		A (n = 20)		Total (n = 102)		*p-value
	No	%	No	%	No	%	No	%	
Age groups									
60-	11	47.8	30	50.8	13	65	54	52.9	0.14
70-	5	21.7	21	35.6	3	15	29	28.5	
≥80-	7	30.5	8	13.6	4	20	19	18.6	
Gender									
Male	15	65.2	32	54.2	15	75	62	60.8	0.23
Female	8	34.8	27	45.8	5	25	40	39.2	
Level of education									
None	17	73.9	32	54.2	7	35	56	54.9	0.01
Primary/preparatory	5	21.7	23	39	7	35	35	34.3	
Secondary school/university	1	4.4	4	6.8	6	30	11	10.8	
Work status									
Working	13	56.5	41	69.5	10	50	64	62.7	0.23
Not working	10	43.5	18	30.5	10	50	38	37.3	
Marital status									
Married	17	73.9	41	69.5	15	75	73	71.6	0.85
Not married	6	26.1	18	30.5	5	25	29	28.4	
General assessment variables									
Live independently									
Yes	15	65.2	53	89.8	17	85	85	83.3	0.03
No	8	34.8	6	10.2	3	15	17	16.7	
Take > 3 prescription drugs per day									
Yes	18	78.3	41	69.5	6	30	65	63.7	0.00
No	5	21.7	18	30.5	14	70	37	36.3	
Pressure sore or skin ulcer									
Yes	9	39.1	13	22	2	10	24	23.5	0.07
No	14	60.9	46	78	18	90	78	76.5	
Mobility									
Bed or chair bound	8	34.8	10	16.9	2	10	20	19.7	0.17
Does not go out	5	21.7	15	25.5	3	15	23	22.5	
Goes out	10	43.5	34	57.6	15	75	59	57.8	
Psychological stress or acute disease									
Yes	10	43.5	12	20.3	4	20	26	25.5	0.08
No	13	56.5	47	79.7	16	80	76	74.5	
Neuropsychological problems									
Severe dementia or depression	5	21.7	0	0.0	0	0	5	4.9	0.00
Mild dementia	6	26.1	15	25.4	0	0	21	20.6	
None	12	52.2	44	74.6	20	100	76	74.5	

M = Malnutrition, RM = Risk of Malnutrition, A = Adequate nutrition. *p-value according to MNA, by the test Chi-square

malnourished, 26.2% were at risk and 69% were well nourished. Moreover, in Saudi Arabia in 2011 a study was conducted by Alhamdan and Alsaif (2011), who found that the prevalence of malnourished elderly was 36.5%, at risk 50.6% and well nourished 12.9%, however in the current study the high percentage of elderly subjects classified as malnourished and at risk of being malnourished may indicate bad dietary habits. In some studies, the level of education was directly associated with nutritional status (Kabir *et al.*, 2006). In the present study, nutritional status was also associated with low level of education, where malnutrition and risk of malnutrition were observed significantly more frequently in illiterate individuals. A higher level of education was possibly associated with higher income and better lifestyle, which in turn resulted in a better nutritional status in these elderly (Saeidlou *et al.*, 2011).

Body mass index is a simple index of weight for height that is frequently used in the assessment of nutritional status. A low BMI, or underweight status, is often associated with an increased risk of mortality in seriously ill or hospitalized older adults (Hausman *et al.*, 2011). Moreover it has been suggested that BMI ranges between 24 and 29 is more appropriate for the elderly population (Alhamdan and Alsaif, 2011). In this study 15.7% of hospitalized elderly patients and 39.1% of the malnourished according to MNA score had a BMI less than 21, similar results were recorded by Oyunkhand *et al.* (2011), while Saeidlou *et al.* (2011) found that 52.8% of hospitalized elderly had a BMI less than 21, however the current study revealed no association between the mean BMI and the three MNA categories, this is inconsistent with Alhamdan and Alsaif (2011) and Bonilla-Palomas *et al.* (2011), who found that the BMI differed significantly between the three groups.

Table 3: Association between MNA score and anthropometric assessment variables for hospitalized elderly patients

Anthropometric assessment variables	M (n = 23)		RM (n = 59)		A (n = 20)		Total (n = 102)		*p-value
	No	%	No	%	No	%	No	%	
Body Mass Index (BMI), (kg/m²)									
<19	3	13.0	4	6.8	0	0	7	6.9	0.01
≥19 - < 21	6	26.2	3	5.1	0	0	9	8.8	
≥21- <23	5	21.7	15	25.4	4	20	24	23.5	
≥23	9	39.1	37	62.7	16	80	62	60.8	
Mid-arm circumference, (cm)									
<21	3	13.0	2	3.4	0	0	5	4.9	0.06
≥21- <22	4	17.4	3	5.1	1	5	8	7.8	
>22	16	69.6	54	91.5	19	95	89	87.3	
Calf circumference (cm)									
<31	16	69.6	27	45.8	7	35	50	49.0	0.06
≥31	7	30.4	32	54.2	13	65	52	51.0	
Weight loss during the last 3 months									
Does not know	6	26.1	18	30.5	3	15	27	26.5	0.02
1-3 kg	14	60.9	27	45.8	6	30	47	46.0	
No	3	13.0	14	23.7	11	55	28	27.5	
Self assessment variables									
Self view of nutritional status									
Malnourished	10	43.5	6	10.2	0	0	16	15.7	0.00
Uncertain of nutrition status	6	26.1	35	59.3	1	5	42	41.2	
No nutritional problem	7	30.4	18	30.5	19	95	44	43.1	
Patient consider his/her health status									
Not as good	11	47.8	11	18.6	0	0	22	21.6	0.00
Didn't know	7	30.5	23	39.0	0	0	30	29.4	
As good	5	21.7	20	33.9	16	80	41	40.2	
Better	0	0.0	5	8.5	4	20	9	8.8	

M = Malnutrition, RM = Risk of Malnutrition, A = Adequate nutrition

Table 4: Association between MNA score and dietary assessment of hospitalized elderly patients

	M (n = 23)		RM (n = 59)		A (n = 20)		Total (n = 102)		*p-value
	No	%	No	%	No	%	No	%	
Number of full meals/day									
1 meal	6	26.1	3	5.1	0	0	9	8.8	0.00
2 meals	10	43.5	26	44.1	3	15	39	38.3	
3 meals	7	30.4	30	50.8	17	85	54	52.9	
Eat dairy products every day									
Yes	17	73.9	50	84.7	20	100	87	85.3	0.05
No	6	26.1	9	15.3	0	0	15	14.7	
Eat legumes or eggs per day									
Yes	10	43.5	34	57.6	17	85	61	59.8	0.02
No	13	56.5	25	42.4	3	15	41	40.2	
Eat meat, fish, or poultry every day									
Yes	14	60.9	43	72.9	20	100	77	75.5	0.01
No	9	39.1	16	27.1	0	0	25	24.5	
Markers of protein intake*									
Yes to 0-1	10	43.5	13	22	0	0	23	22.5	0.00
Yes to 2	6	26.1	20	33.9	3	15	29	28.4	
Yes to 3	7	30.4	26	44.1	17	85	50	49.1	
Eat fruit or vegetables twice per day									
Yes	10	43.5	43	72.9	20	100	73	71.6	0.00
No	13	56.5	16	27.1	0	0	29	28.4	
Daily fluid consumption (cups/day)									
<3	9	39.1	6	10.2	0	0	15	14.7	0.00
3-5	13	56.5	34	57.6	9	45	56	54.9	
>5	1	4.4	19	32.2	11	55	31	30.4	
Mode of feeding									
Need assistance	8	34.8	1	1.7	0	0	9	8.8	0.00
Self-fed with difficulty	6	26.1	5	8.5	0	0	11	10.8	
Self-fed without difficulty	9	39.1	53	89.8	20	100	82	80.4	
Decline in food intake during the last 3 months									
Severe	12	52.2	6	10.2	0	0	18	17.6	0.00
Moderate	9	39.1	31	52.5	6	30	46	45.1	
None	2	8.7	22	37.3	14	70	38	37.3	

M = Malnutrition, RM = Risk of Malnutrition, A = Adequate nutrition

Table 5: Spearman correlation between total MNA score and the different MNA subgroup questions

Variables	R*	p-value
Anthropometric assessment variables		
Body Mass Index (BMI) (kg/m ²)	0.38	0.00
Mid-arm circumference (cm)	0.29	0.00
Calf circumference (cm)	0.19	0.05
General assessment variables		
Weight loss during the last 3 months	0.24	0.02
Live independently	0.19	0.04
Take > 3 prescription drugs per day	0.37	0.00
Pressure sore or skin ulcer	0.34	0.00
Mobility	0.33	0.00
Psychological stress or acute disease	0.30	0.00
Neuropsychological problems	0.40	0.00
Dietary assessment variables		
Number of full meals/day	0.51	0.00
Markers of protein intake	0.47	0.00
Eating fruit or vegetables twice a day	0.46	0.00
Daily fluid consumption	0.50	0.00
Mode of feeding	0.52	0.00
Decline in food intake during the last 3 months	0.49	0.00
Self assessment variables		
Self view of nutritional status	0.57	0.00
Self view of his/her health status	0.61	0.00

*Correlation coefficient

Involuntary weight loss is an important indicator of significant decline in health and function, resulting in a higher risk for infection, depression and death. Although it is important to recognize that periods of substantially positive or negative energy balance and body weight fluctuation occur as a normal part of life, a weight loss greater than 5% over six months should be investigated (Lewko *et al.*, 2003).

In the current study, It was found that 46.0% of the hospitalized elderly lost between 1-3 kg during the previous 3 months, this result disagree with Oyunkhand *et al.* (2011), who found that only 9% had weight loss during the last 3 months. Moreover the results of the present study shows, significant association between history of weight loss during the last 3 months and malnutrition status using the MNA score, similar results were recorded by Oliveira *et al.* (2009).

Regarding the general assessment section of the MNA score, 42.1% of total hospitalized patients were moderately mobile or immobile, similar results were observed by Volkert *et al.* (2011), however no association was detected between the degree of mobility and nutrition status as classified by the MNA score, in contrast to Oliveira *et al.* (2009), who found that significantly higher percentage of malnourished hospitalized elderly patients (52.8%) were bedbound or wheelchair-bound.

Results revealed that 63.7% of hospitalized elderly were taking more than 3 drugs per day in agreement with Volkert *et al.* (2011), while in contrast to Oyunkhand *et al.* (2011), who found that only 15.7% were on 3 or more medications per day. Moreover, 78.3% of malnourished elderly were taking more than 3 prescription drugs per

day based on MNA score, nearly similar result was reported by Saeidlou *et al.* (2011) and by Alhamdan and Alsaif (2011), this finding may possibly be due to the fact that elderly people had conditions that required medications as a result of poor nutrition in the first place. Elderly people often have higher prevalence of diseases leading to lower food intake due to pain, nausea, confusion, immobility and drug side effects (Saeidlou *et al.*, 2011).

Studies that used MNA score, found that poor nutritional status has been associated with many illnesses such as dementia, depression and a longer length of stay in hospitals (Saeidlou *et al.*, 2011; Milne *et al.*, 2006). In this study 25.4% of the studied hospitalized elderly patients suffered from neuropsychological problems, this result was compatible with Oyunkhand *et al.* (2011). In addition, the current study revealed that, a significant proportion of malnourished patients and those who were at risk of malnutrition suffered from severe or mild dementia and high dependency, similar results were reported by Saeidlou *et al.* (2011) and Oliveira *et al.* (2009), in contrast to Volkert *et al.* (2011), who found that 59.7% and 38.7% of hospitalized patients suffered from dementia and depression respectively.

The role of nutrition in the maintenance of elderly individuals' health, management of chronic conditions, treatment of serious illnesses and rehabilitation of functional limitations has risen for public interest and research during the last decades (Milne *et al.*, 2006). In this study the MNA subgroup questionnaire related to dietary assessment shows significant association between the MNA score and nutritional status of the elderly except for consumption of dairy products, A study conducted by Alhamdan and Alsaif in Saudi Arabia in 2011 reported similar results, who found that 90.1% of the elderly had one or two meals daily.

Regarding the intake of meat, fish and poultry per day, results of this study were inconsistent to that presented by Alhamdan and Alsaif (2011) and Saeidlou *et al.* (2011), where both observed lower percentage of consumption of meat, fish and poultry than the current study.

High consumption of fruits and vegetables reduces many chronic diseases such as stroke, cardiovascular disease, metabolic disease and some cancers (Bertsias *et al.*, 2005; Dauchet *et al.*, 2006; Donini *et al.*, 2009; Elmadfa and Freisling, 2005). They contain essential vitamins, minerals, fibers and other bioactive compounds (Sabzghabae *et al.*, 2010; Salehi *et al.*, 2010).

In this study 71.6% of the elderly consumed two or more servings of fruits or vegetables per day, similar results were recorded by Oyunkhand *et al.* (2011), on the other hand 56.5% of the malnourished elderly and 27.1% of those who were at risk of malnutrition did not, inconsistent results were recorded by Saeidlou *et al.* (2011).

In elderly individuals, one important effect of dehydration is an alteration of many crucial physical and mental functions that affect life expectancy (Bellisle *et al.*, 2010; Ferry, 2005). In the current study the daily fluid consumption of 5 cups or less was recorded by 69.6% of elderly, however, Alhamdan and Alsaif's in (2011) found different results, where 89.4% of the elderly stated that they consumed less than or equal 5 cups per day. Inconsistent results were also recorded by Oyunkhand *et al.* (2011), who observed that 20% of the elderly consumed less than 5 glasses of fluid daily.

In this study 52.2% of the malnourished elderly had severe decline in food intake in the past 3 months, similar results were observed by Oliveira *et al.* (2009). Results reported by Alhamdan and Alsaif (2011) disagree with this study where 28.2% of the elderly experienced a decline in the food intake during the same period due to loss of appetite, digestive problems or chewing or swallowing problems, however in the current study 60.9% of the malnourished group either need assistance in feeding or self fed with difficulty which could explain this inconsistency.

Regarding the self view of nutritional status, a significant association was found between the three groups, where 43.5% of the malnourished elderly considered themselves as malnourished, 30.4% did not know that they had a nutritional problem, Oyunkhand *et al.* (2011), had different results where 20% of those who were malnourished did not know that they were malnourished, whereas 2.4% did know.

Limitations: In addition to the small sample size of the study, this study was restricted to two general hospitals and no private hospitals were included, so the results may not be generalized to other hospitals. Over- and underestimation of intakes are a notable limitation of all self-reported dietary assessment data. Under-reporting of intakes cannot be ruled out in this study.

Conclusion: Malnutrition is a common problem among hospitalized older people. Most of the studied hospitalized elderly were classified as being malnourished, or at risk of malnutrition. The study indicated the necessity of performing the MNA test for elderly upon admission to hospitals and more attention need to be paid to this vulnerable group of people.

REFERENCES

Alhamdan, A.A. and A.A. Alsaif, 2011. The nutritional, glutathione and oxidant status of elderly subjects admitted to a University Hospital. *The Saudi J. Gastroenterol.*, 17: 58-63.

Bellisle, F., S.N. Thornton, P. Hebel, M. Denizeau and M. Tahiri, 2010. A study of fluid intake from beverages in a sample of healthy French children, adolescents and adults. *Eur. J. Clin. Nutr.*, 64: 350-355.

Bertsias, G., M. Linardakis, I. Mammias and A. Kafatos, 2005. Fruit and vegetables consumption in relation to health and diet of medical students in Crete, Greece. *Int. J. Vitam. Nutr. Res.*, 75: 107-117.

Bonilla-Palomas, J.L., A.L. Gamez-Lopez, M.P. Anguita-Sánchez, J.C. Castillo-Domínguez, D. García-Fuertes and M. Crespin-Crespin, 2011. Impact of Malnutrition on Long-Term Mortality in Hospitalized Patients With Heart Failure, REC-194; No. of Pages 7 *Rev Esp Cardiol.*

Capderou, A., M. Berkani, M.H. Becquemin and Zelter, 2011. Reconsidering the arm span-height relationship in patients referred for spirometry. *ERJ.*, 37: 157-163.

Dauchet, L., P. Amouyel, S. Hercberg and J. Dallongeville, 2006. Fruit and vegetable consumption and risk of coronary heart disease: A meta-analysis of cohort studies. *J. Nutr.*, 136: 2588-2593.

Donini, L.M., C. Savina and C. Cannella, 2009. Nutrition in the elderly: Role of fiber. *Arch. Gerontol. Geriatr.*, 49 Suppl 1: 61-69.

Elmadfa, I. and H. Freisling, 2005. Fat intake, diet variety and health promotion. *Forum. Nutr.*, 57: 1-10.

Ferdous, T., Z.N. Kabir and T. Cederholm, 2007. Prevalence of malnutrition and determinants of nutritional status among elderly people: a population based study in rural Bangladesh. *Akademick Avhandling.*

Ferry, M., 2005. Strategies for ensuring good hydration in the elderly. *Nutr. Rev.*, 63: S22-S29.

Gariballa, S. and S. Forster, 2007. Associations between underlying disease and nutritional status following disease and nutritional status following acute illness in older people. *Clin. Nutr.*, 26: 466-473.

Hausman, D.B., M.A. Johnson, A. Davey and L.W. Poon, 2011. Body mass index is associated with dietary patterns and health conditions in Georgia Centenarians. *J. Aging Res.*, Article ID 138015.

Ibrahim, N.K., M.T. Ghabrah and M. Qadi, 2005. Morbidity profile of elderly attended/admitted in Jeddah Health Facilities, Saudi Arabia. *Bull. High Inst. Public Health*, 35: 173-190.

Joshi, K., R. Kumar and A. Avasthi, 2003. Morbidity profile and its relationship with disability and psychological distress among elderly people in Northern India. *Int. J. Epidemiol.*, 32: 978-987.

Kabir, Z.N., T. Ferdous, T. Cederholm, M.A. Khanam, K. Streatfield and A. Wahlin, 2006. Mini nutritional assessment of ruralelderly people in Bangladesh: the impact of demographic, socioeconomic and health factors. *Public Health Nutr.*, 9: 968-974.

Kagansky, N., Y. Berner, N. Koren-Morag, L. Perelman, H. Knobler and S. Levy, 2005. Poor nutritional habits are predictors of poor outcome in very old hospitalized patients. *Am. J. Clin. Nutr.*, 82: 784-791.

- Lewko, M., A. Chamseddin, M. Zaky and R.B. Birrer, 2003. Weight loss in the elderly: What's normal and what's not, 734 P&T® • Vol. 28 No. 11.
- Mahan, L.K. and L.S. Escott-Stump, 2008. Nutrition in aging, Chapter (10) in Krause's Food and Nutrition Therapy, 12 Edn., Published by W.B. Saunders Company, pp: 287-308.
- Milne, A.C., A. Avenell and J. Potter, 2006. Meta-analysis: Protein and energy supplementation in older people. *Ann. Internal Med.*, 144: 37-48.
- Oliveira, R.M., K.C. Fogaca and V.A. Leandro-Merhi, 2009. Nutritional status and functional capacity of hospitalized elderly. *Nutr. J.*, 8: 54.
- Oyunkhand, R., E. Byambasuren, B. Batsereedene, O. Chimedsuren and S. Byambasuren, 2011. Nutritional status of Mongolian elderly. *Asian J. Gerontol. Geriatr.*, 6: 42-46.
- Sabzghabae, M.A., P. Mirmoghtadaee and M. Mohammadi, 2010. Fruits and vegetables consumption among community dwelling elderly in an Iranian population. *Int. J. Prev. Med.*, 1: 99-103.
- Saeidlou, N.S., K.T. Merdol, P. Mikaili and Y. Bektas, 2011. Assessment of the nutritional status of elderly people living at nursing home in Northwest IRAN, Vol. 3. No. 1. Part II.
- Salehi, L., H. Eftekhar, K. Mohammad, S.S. Tavafian, A. Jazayeri and A. Montazeri, 2010. Consumption of fruit and vegetables among elderly people: A cross sectional study from Iran. *Nutr. J.*, 9: 2.
- Santos, J.L., C. Albala, L. Lera, C. Garcia, P. Arroyo and F. Perez-Bravo, 2004. Anthropometric measurements in the elderly population of Santiago, Chile. *Nutr.*, 20: 452-457.
- Soini, H., P. Routasalo and H. Lagstrom, 2004. Characteristics of the mini-nutritional assessment in elderly home-care patients. *Eur. J. Clin. Nutr.*, 58: 64-70.
- UN World Population Prospects, 2008. Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2009). *World Population Prospects: The 2008 Revision*. New York : United Nations.
- Volkert, D., L. Pauly, P. Stehle and C.C. Sieber, 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: 9.
- Yalcin, B.M., E.M. Sahin and E. Yalcin, 2004. Prevalence and epidemiological risk factors of obesity in Turkey. *Middle East J. Family Med.*, 6: 6.