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Research Article
Effect of Physical Activity and Gender on Malnutrition Risk Among a Group of Elderly Jordanians

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Abstract

Background and Objective: This study was designed to assess the prevalence of malnutrition and it's associated risk factors among elderly Jordanians and to evaluate the effect of physical activity and gender on malnutrition risk. **Materials and Methods:** In this cross sectional study, sixty elderly individuals (>65 years) were screened for the risk of malnutrition based on gender and physical activity. Malnutrition risk scores were calculated using the nutrition screening initiative (NSI) DETERMINE checklist and the mini-nutritional assessment short-form (MNA-SF). **Results:** According to the NSI and MNA-SF, 48.7 and 18.3% of study participants were malnourished, respectively. The NSI checklist revealed significant differences ($p<0.05$) between the active and inactive groups with regards to diet (eating few fruits or vegetables or milk products), tooth or mouth problems (that make eating difficult), the amount of money available to buy food and the physical ability to shop, cook and/or feed oneself. The MNA-SF checklist showed significant differences ($p<0.05$) with regards to food intake and mobility. In addition, the NSI checklist also showed significant differences between males and females with regards to tooth or mouth problems ($p = 0.0576$) and the physical ability to shop, cook and/or feed oneself ($p = 0.0501$). **Conclusion:** Elderly Jordanians have a high risk of malnutrition and this risk is more prevalent in physically inactive elderly males.

Key words: Malnutrition, elderly, NSI, MNA-SF, physical activity, gender

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The worldwide population of elderly (>65 years-old) is increasing[1]. In developed countries such as the United States (US) and Europe, as well as in developing countries like Jordan, the ratio of old to young people is also increasing. In the United States in 1900, 1 out of 25 people was elderly. By 2000, 1 in 8 people was elderly and this ratio is expected to increase to 1 in 5 people by 2030[2]. In 2004, the Office of National Statistics reported that about 16% of the European population was over 65 years-old[3]. In 2015, 3.7% of the Jordanian population was older than 65 and this percentage is expected to reach 7.6% by 2020[4]. The growing size of the elderly population worldwide has increased the frequency of many problems associated with aging, such as malnutrition[2,5].

The World Health Organization (WHO) defines malnutrition as "the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance and specific functions"[6]. Malnutrition is a major health issue among geriatric populations and is strongly associated with illness and death worldwide[7-10]. Moreover, up to 85% of nursing home residents, 23-62% of hospitalized patients and up to 15% of community and home-bound elderly people are considered to be malnourished[11].

The multifactorial etiology of malnutrition arises from a combination of physiological changes related to age, lower socio-economic status, comorbidities, certain medications and physical inactivity[12-15].

In the elderly, distinguishing malnutrition from the aging process itself can be challenging. Therefore, understanding, evaluating and detecting nutritional risk factors associated with aging is important[16]. In addition, individualized care plans to detect the early stages of malnutrition in elderly people will help to improve their quality of life[5].

Although malnutrition should be an important element of a comprehensive assessment, the condition may be underestimated in routine clinical practice. Nutrition screening tests designed for assessing elderly people must be noninvasive, rapid and easy to use. The two more widely used screening tests are the nutrition screening initiative DETERMINE checklist (NSI) and the mini-nutritional assessment short-form (MNA-SF). The aim of this study was to assess the prevalence of malnutrition and its risk factors among a group of elderly Jordanian people and to evaluate the effect of physical activity and gender on malnutrition risk.

MATERIALS AND METHODS

Study population and design: A cross sectional study was conducted on 60 elderly Jordanian people (mean age, 70±7.2 years) living in Amman (31 women, 29 men) who were screened for the risk of malnutrition after they signed a consent form. The study participants were divided into two groups, the first group consisted of 20 individuals who had visited a gym at least twice a week for the last 2 years and the second group consisted of 40 individuals who were home residents or physically inactive. Individuals suffering from acute illness, bedridden patients and those receiving artificial feeding were excluded from the study. A structured valid and reliable questionnaire was used for collecting personal, social, medical, nutritional and life-style information, including daily activities and anthropometric measurements through a personal interview conducted by the principal investigator.

Anthropometric measurements

Height and weight: Height was measured using the same stadiometer for all participants. To ensure accurate measurements, all study participants were measured while barefooted and wearing minimal clothing. To facilitate correct positioning, participants were instructed to keep their legs straight and place their heels together, hold their arms to their sides, with their shoulders relaxed and their head positioned according to the Frankfort horizontal plane. Measurements were recorded to the nearest 0.5 cm[17].

Weight was measured for all participants using the same beam scale (Seca 700 physician's beam scale). The scale was calibrated and checked for zero-balance before each measurement. For the weight measurements, participants were barefooted and wore minimal clothing. They were asked to stand unassisted on the center of the scale and look straight ahead. The measurement was recorded to the nearest 0.1 kg[17].

Body mass index (BMI): Body mass index was calculated according to Quetelet's formula[17]:

$$BMI = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

Tools for assessment of malnutrition risk: The prevalence of malnutrition and associated risk factors among study subjects was determined using two assessment tools: the NSI and the MNA-SF. The NSI was developed by the US nutrition screening initiative, a collaborative effort between the American academy of family physicians, the national council on aging and the American Dietetic Association[18]. The MNA-SF is a screening tool used to identify malnourished elderly people or those who are at risk for malnutrition. The MNA-SF is based on the original 18 item questionnaire known as the full MNA[19].

The NSI is a screening tool that consists of 10 questions weighted with a numerical score and a cumulative score ranging from 0-21. Subjects having a cumulative score of 0-2 are classified as good. A score of 3-5 indicates moderate nutritional risk, whereas those with a score of ≥6 are at high nutritional risk[18]. The MNA-SF consists of 6 questions that address food intake, mobility, weight loss, acute disease, psychological stress presence of dementia or depression and body mass index (BMI). Individuals with scores of 12-14 are considered to have a normal nutritional status, 8-11 indicates a risk for malnutrition and 0-7 indicates malnutrition[20].

Ethical approval: This study was conducted according to the Declaration of Helsinki[21] (2008, including 2013 amendments) and written informed consent was obtained from all participants.

Data analysis: Collected data from the cross-sectional study were entered twice in data sheets, checked and analyzed. Based on the NSI and MNA-SF scores, subjects were classified into two variables according to physical activity and gender. Descriptive statistics were performed using frequency and means with standard deviation to describe the categorical and numerical data, respectively. Chi-square test was used to compare the categorical variables and Fisher's exact test was used when one of the cells was ≤5. Analyses were performed using GraphPad Prism 5 software (San Diego, CA) and p-value ≤0.05 was considered as significant.

RESULTS

A total of 60 elderly people participated in this study. The mean age was 70±7.2 years and the gender distribution was 48.3 and 51.7% male and female, respectively. Among the group, 33.3% were physically active and 66.7% were physically inactive. According to the NSI checklist, 48.7% of study participants were malnourished, whereas the MNA-SF checklist rated 18.3% as being malnourished. In terms of gender, the NSI screening test showed that 37.5% of males and 62.5% of females had no risk of malnutrition, whereas 38.5% of males and 61.5% of females had a moderate risk of malnutrition and 58.1% of males and 41.9% of females were malnourished. Meanwhile, the MNA-SF checklist showed that 57.1% of males and 42.9% of females had normal nutrition, whereas 43.2% of males and 56.8% of females were at risk for malnutrition and 55.6% of males and 44.4% of females had malnutrition (Table 1).

Table 2 showed that there were significant differences (p≤0.05) in the answers of the NSI checklist questions among the active and inactive groups. These answers include the differences in diet (amount of fruits, vegetables and dairy products consumed), tooth or mouth problems (make eating difficult), the availability of money (reduced the ability to buy food) and the physical ability to shop, cook and/or feed oneself. Significant differences (p≤0.05) were also found between active and inactive groups in all NSI malnutrition risk scores. While the answers of the MNA-SF checklist questions

Table 1: Descriptive statistics of the study participants/gender and malnutrition screening test

Screening test	Male (n = 29)	Female (n = 31)
NSI	n (%)	n (%)
No risk	6 (37.5%)	10 (62.5%)
Moderate risk	5 (38.5%)	8 (61.5%)
Malnutrition	18 (58.1%)	13 (41.9%)
MNA-SF	n (%)	n (%)
Normal nutrition	8 (57.1)	6 (42.9%)
Risk of malnutrition	16 (43.2%)	21 (56.8%)
Malnutrition	5 (55.6%)	4 (44.4%)

Values are presented as frequency (n) and percentages (%)

Table 2: Physical activity and group dependent frequency of affirmative answers to NSI DETERMINE checklist

NSI DETERMINE checklist questions	Physically active (n = 20)	Physically inactive (n = 40)	p-value (X^2)
I have an illness or condition that made me change the kind and/or amount of food I eat	4 (20.0%)	18 (45.0%)	0.0881
I eat fewer than two meals/day	0 (00.0%)	11 (27.5%)	0.0881
I eat few fruits or vegetables, or milk products	0 (00.0%)	22 (55.0%)	<0.0001
I have three or more drinks of beer, liquor or wine almost every day	0 (00.0%)	1 (2.5%)	1
I have tooth or mouth problems that make it hard for me to eat	7 (35.0%)	35 (87.5%)	<0.0001
I don't always have enough money to buy the food I need	0 (00.0%)	8 (20.0%)	0.0431
I eat alone most of the time	7 (35.0%)	11 (27.5%)	0.564
I take three or more different prescribed or over-the-counter drugs a day	9 (45.0%)	13 (32.5%)	0.402
Without wanting to, I have lost or gained 10 pounds in the last 6 month	3 (15.0%)	10 (25.0%)	0.512
I am not always physically able to shop, cook and/or feed myself	0 (00.0%)	18 (45.0%)	0.0085
NSI risk score			
> 6 (malnutrition)	0 (00.0%)	30 (75.0%)	<0.0001
3-5 (moderate risk)	13 (65.0%)	6 (15.0%)	0.0002
0-2 (no risk)	7 (35.0%)	4 (10.0%)	0.0315

Values are presented as frequency (n) and percentages (%), p<0.05 is statistically significant for Chi-square test

Table 3: Physical activity and group dependent frequency of affirmative answers to MNA-SF checklist

MNA-SF checklist questions	Physically active (n=20)	Physically inactive (n=40)	p-value (X^2)
Food intake declined	2 (10.0%)	15 (37.0%)	0.0340
Weight loss during the last 3 months	7 (35.0%)	10 (25.0%)	0.5449
Mobility	0 (00.0%)	12 (30.0%)	0.0053
Psychological stress or acute disease	9 (45.0%)	20 (50.0%)	0.7881
Neuropsychological problems	0 (00.0%)	5 (12.5%)	0.1588
BMI $\geq$23	17 (85%)	34 (85%)	1
MNA-SF risk score			
0-7 (malnutrition)	0 (00.0%)	11 (27.5%)	0.0108
8-11 (at risk of malnutrition)	5 (25.0%)	22 (55.0%)	0.0322
12-14 (normal nutrition)	15 (75.0%)	7 (17.5%)	0.0001

Values are presented as frequency (n) and percentages (%), p<0.05 is statistically significant for Chi-square test

Table 4: Gender and group dependent frequency of affirmative answers to NSI DETERMINE checklist

NSI DETERMINE checklist questions	Male (n = 29)	Female (n = 31)	p-value (X^2)
I have an illness or condition that made me change the kind and/or amount of food I eat	9 (31.03%)	10 (32.26%)	1
I eat fewer than two meals/day	3 (10.31%)	8 (25.81%)	0.1838
I eat few fruits or vegetables, or milk products	7 (24.14%)	12 (38.71%)	0.274
I have three or more drinks of beer, liquor or wine almost every day	1 (34.48%)	0(00.0%)	0.4833
I have tooth or mouth problems that make it hard for me to eat	15 (51.72%)	24 (77.42%)	0.0576
I don't always have enough money to buy the food I need	2 (6.90%)	6 (19.35%)	0.2566
I eat alone most of the time	7 (24.14%)	10 (32.26%)	0.5725
I take three or more different prescribed or over-the-counter drugs a day	8(27.59%)	12 (38.71%)	0.4194
Without wanting to, I have lost or gained 10 pounds in the last 6 month	6 (20.69%)	7 (22.58%)	1
I am not always physically able to shop, cook and/or feed myself	5 (17.24%)	13 (41.94%)	0.0501
NSI risk score			
> 6 (malnutrition)	18 (62.06%)	13 (41.94%)	0.1188
3-5 (moderate risk)	5 (17.24%)	8 (25.80%)	0.5358
0-2 (no risk)	6 (20.68%)	10 (32.25%)	0.3873

Values are presented as frequency (n) and percentages (%), p<0.05 is statistically significant for Chi-square test

Table 5: Gender and group dependent frequency of affirmative answers to MNA-SF checklist

MNA-SF checklist questions	Male (n=29)	Female (n=31)	p-value (X^2)
Food intake declined	5 (17.24%)	12 (38.71%)	0.0881
Weight loss during the last 3 months	10 (34.48%)	6 (19.35%)	0.2465
Mobility	3 (10.34%)	9 (29.03%)	0.1070
Psychological stress or acute disease	14 (48.28%)	16 (51.61%)	1
Neuropsychological problems	1 (3.45%)	4 (12.9%)	0.3547
BMI >23	23 (79.3%)	28 (90.3%)	0.2923
MNA -SF risk score			
0-7 (malnutrition)	5 (17.24%)	4 (12.90%)	0.7270
8-11 (at risk of malnutrition)	6 (55.17%)	21(67.74%)	0.4267
12-14 (normal nutrition)	8 (27.58%)	6 (19.31%)	0.5474

Values are presented as frequency (n) and percentages (%), p<0.05 is statistically significant for Chi-square test

among active and inactive groups, showed significant differences (p<0.05) with regards to food intake and mobility. In addition, significant differences (p<0.05) were also shown between active and inactive groups in all MNA-SF malnutrition risk scores (Table 3).

Gender and group dependent frequency of affirmative answers to the NSI checklist showed borderline differences between males and females regarding tooth or mouth problems (make eating difficult) (p = 0.0576) and physical limitations that affected the ability to shop, cook and/or feed themselves (p = 0.0501). None of the NSI malnutrition risk scores were statistically significant (p>0.05) (Table 4). Meanwhile, comparing males and females using the MNA-SF checklist showed no significant differences (p>0.05) between any MNA-SF checklist questions or MNA-SF risk scores (Table 5).

DISCUSSION

The study revealed that the prevalence of malnutrition among the total study group as determined by the NSI checklist was 48.7% and the rate was higher among physically

inactive males. On the other hand, 18.3% were malnourished according to the MNA-SF checklist and the rate was also higher among physically inactive males. This result is consistent with a previous study conducted by Wojszel[15], who used the NSI checklist to show a high risk of malnutrition (50.8%) of respondents over 75 years of age who were living in rural areas in Poland. Similarly, other researchers reported high rates of malnutrition risk among elderly people assessed using the same scale[22-25]. However, due to the diversity of the study populations a detailed comparison of results could not be performed.

The NSI checklist showed that elderly individuals who were physically inactive had a significantly higher risk of malnutrition (Table 2). Moreover, these individuals had risk factors for malnutrition due to: consumption of fewer fruits or vegetables and less dairy products, dental problems that compromised the ability to eat, insufficient funds to purchase necessary amounts of food, or physical limitations that affected the ability to shop, cook and/or feed themselves. As such, the NSI malnutrition risk scores were significantly higher among physically inactive elderly individuals. In a study about hospitalized elderly individuals, Esmayel *et al.*[26] found that 56% of participants were at high risk, 18% were at moderate risk of malnutrition and 26% had good nutrition[26]. Furthermore, the nutritional risk was higher in patients with lower income whereas patients with moderate income had good nutrition. Rural residents had a higher nutritional risk than urban residents (61.9% vs. 25%). From these results, the authors concluded that hospitalized elderly patients are at risk of malnutrition and in turn functional impairment.

In the current study, responses to MNA-SF checklist questions, significant differences were observed between the physically active and inactive groups. Based on MNA-SF checklist questions, the inactive group showed lower food intake and mobility and higher risk of malnutrition (Table 3). Beck *et al.*[27] used the MNA-SF to assess the nutritional risk of 171 subjects and reported that 78.4% were well-nourished, while 21.6% were at risk of undernutrition but they did not consider physical activity. Overall, there is a limited number of studies regarding assessment of malnutrition as a function of physical activity among elderly people using NSI assessment tool, so an extensive comparison of the current results with previous findings could not be performed.

The answers of the NSI checklist questions according to gender, showed nearly significant differences between males and females with regards to dental problems ($p = 0.0576$) and the physical ability to shop, cook and/or feed oneself ($p = 0.0501$). The remainder of the NSI malnutrition risk scores were not significantly different between males and females (Table 4). In the MNA-SF checklist questions, there was no significant differences in any of the checklist questions or MNA-SF malnutrition risk scores between males and females (Table 5). These findings are inconsistent with those of Wojszel[15], who showed significant differences by gender using the NSI checklist. Wojszel[15] also found that more men than women admitted to drink three or more glasses of alcohol daily and that more women than men ate alone and took at least three medications daily.

The NSI and MNA-SF nutritional screening tools are simple, inexpensive and non-invasive and thus are widely used in clinical research for rapid geriatric assessment[28]. The validity of the full MNA questionnaire has been shown in many elderly research studies conducted in hospital, nursing home, ambulatory care and community settings[20,29]. However, studies to validate the reliability of the MNA-SF are limited[30].

This study has some limitations, including the small sample size, lack of participants living in rural areas, exclusion of bedridden elderly[30] and use of the MNA-SF rather than full MNA questionnaire.

CONCLUSION

Results of the current study showed that elderly people have a high risk of malnutrition, which is more prevalent among physically inactive elderly males. The NSI malnutrition assessment test appears to be superior to the MNA-SF in the identification of malnourished elderly people by gender. However, both questionnaires were able to distinguish malnourished elderly by physical activity. Accordingly, national policy makers should focus on the elderly people to heighten awareness of the importance of physical activity, dental care and social activity. Finally, it is suggested that the NSI checklist should be used as a part of routine medical care for the elderly due to its ease of use and rapid screening.

SIGNIFICANCE STATEMENT

This study revealed the possible beneficial role of physical activity in elderly individuals who are at risk of malnutrition. The results also showed that the NSI screening test was a better predictor of malnutrition as a function of gender. The study findings will help to promote the identification of malnourished elderly people and assist health policy makers in increasing the awareness of the importance of physical activity among this age group. The study will also help to reveal critical areas of malnutrition among the growing elderly population.

REFERENCES

1. Centers for Disease Control and Prevention, 2003. Public health and aging: Trends in aging-United States and worldwide. J. Am. Med. Assoc., 289: 1371-1373.
2. Hickson, M., 2006. Malnutrition and ageing. Postgrad. Med. J., 82: 2-8.
3. ONS., 2004. Population trends. PT 118, Table 1.4 (Population age and sex). Office of National Statistics (ONS), London, UK.
4. National Council for Family Affairs, 2010. Older persons in Jordan. https://social.un.org/ageing-working-group/documents/fourth/Jordan.pdf
5. Ahmed, T. and N. Haboubi, 2010. Assessment and management of nutrition in older people and its importance to health. Clin. Interventions Aging, 5: 207-216.
6. De Onis, M., C. Monteiro, J. Akre and G. Clugston, 2002. The worldwide magnitude of protein-energy malnutrition: An overview from the WHO global database on child growth. Bull. World Health Organ., 71: 703-712.
7. 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.
8. Sibai, A.M., C. Zard, N. Adra, M. Baydoun and N. Hwalla, 2003. Variations in nutritional status of elderly men and women according to place of residence. Gerontology, 49: 215-224.
9. Cowan, D.T., J.D. Roberts, J.M. Fitzpatrick, A.E. While and J. Baldwin, 2004. Nutritional status of older people in long term care settings: Current status and future directions. Int. J. Nurs. Stud., 41: 225-237.
10. Wojszel, Z.B., 2006. Determinants of nutritional status of older people in long-term care settings on the example of the nursing home in Bialystok. Adv. Med. Sci., 51: 168-173.
11. Morley, J.E., 1997. Anorexia of aging: Physiologic and pathologic. Am. J. Clin. Nutr., 66: 760-773.
12. Morley, J.E., 1995. Anorexia of Ageing and Protein-Energy Undernutrition. In: Geriatric Nutrition: A Comprehensive Review, Morley, J.E., Z. Glick and L.Z. Rubenstein (Eds.). 2nd Edn., Raven Press, New York, USA., ISBN-13: 978-0781701693, pp: 75-78.
13. Barrocas, A., J.V. White, C. Gomez and L. Smithwick, 1996. Assessing health status in the elderly: The nutrition screening initiative. J. Health Care Poor Underserved, 7: 210-218.
14. Rolls, B.J. and A. Drewnowski, 1996. Diet and Nutrition. In: Encyclopedia of Gerontology: Age, Aging and the Aged, Birren, J.E. (Ed.). 1st Edn., Academic Press, San Diego, USA., ISBN-13: 978-0122268601, pp: 429-440.
15. Wojszel, Z.B., 2012. Use of NSI Determine Checklist to assess the risk of malnutrition in persons of advanced old age living in rural areas. Progr. Health. Sci., 2: 68-75.
16. Sahyoun, N.R., 1999. Usefulness of nutrition screening of the elderly. Nutr. Clin. Care, 2: 155-163.
17. Lee, R.D. and D.C. Nieman, 2010. Nutritional Assessment. 5th Edn., McGraw-Hill, Dubuque, IA., USA., ISBN: 9780071267724, Pages: 580.
18. Barrocas, A., B.R. Bistrian, G.L. Blackburn, R. Chernoff and D.A. Lipschitz *et al*., 1995. Appropriate and effective use of the NSI checklist and screens. J. Acad. Nutr. Dietet., 95: 647-648.
19. Guigoz, Y., B. Vellas and P.J. Garry, 1994. Mini nutritional assessment: A practical assessment tool for grading the nutritional state of elderly patients. Facts Res. Gerontol., 5: 15-59.
20. Kaiser, M.J., J.M. Bauer, C. Ramsch, W. Uter and Y. Guigoz *et al*., 2009. Validation of the Mini Nutritional Assessment Short-Form (MNA®-SF): A practical tool for identification of nutritional status. J. Nutr. Health Aging, 13: 782-788.
21. Puri, K.S., K.R. Suresh, N.J. Gogtay and U.M. Thatte, 2009. Declaration of Helsinki, 2008: Implications for stakeholders in research. J. Postgrad. Med., 55: 131-134.
22. Coulston, A.M., L. Craig and A.C. Voss, 1996. Meals-on-wheels applicants are a population at risk for poor nutritional status. J. Am. Dietet. Assoc., 96: 570-573.
23. De Groot, L.C.P.G.M., A.M. Beck, M. Schroll and W.A. van Staveren, 1998. Evaluating the DETERMINE Your Nutritional Health Checklist and the Mini Nutritional Assessment as tools to identify nutritional problems in elderly Europeans. Eur. J. Clin. Nutr., 52: 877-883.
24. Yap, K.B., M. Niti and T.P. Ng, 2007. Nutrition screening among community-dwelling older adults in Singapore. Singapore Med. J., 48: 911-916.
25. Brownie, S., S.P. Myers and J. Stevens, 2007. The value of the Australian Nutrition Screening Initiative for older Australians-results from a national survey. J. Nutr. Health Aging, 11: 20-25.
26. Esmayel, E.M., M.M. Eldarawy, M.M.M. Hassan, H.M. Hassanin, W.M.R. Ashour and W. Mahmoud, 2013. Nutritional and functional assessment of hospitalized elderly: Impact of sociodemographic variables. J. Aging Res. 10.1155/2013/101725.
27. Beck, A.M., L. Ovesen and M. Osler, 1999. The 'Mini Nutritional Assessment' (MNA) and the 'DETERMINE Your Nutritional Health' Checklist (NSI Checklist) as predictors of morbidity and mortality in an elderly Danish population. Br. J. Nutr., 81: 31-36.
28. Cereda, E., 2012. Mini nutritional assessment. Curr. Opin. Clin. Nutr. Metab. Care, 15: 29-41.
29. Guigoz, Y., 2006. The Mini Nutritional Assessment (MNA®) review of the literature-What does it tell us? J. Nutr. Health Aging, 10: 466-487.
30. Skates, J.J. and P.S. Anthony, 2012. Identifying geriatric malnutrition in nursing practice: The Mini Nutritional Assessment (MNA®)-an evidence-based screening tool. J. Gerontol. Nurs., 38: 18-27.