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WHICH ARE THE MOST EFFICIENT ITEMS OF MINI NUTRITIONAL ASSESSMENT IN MULTIMORBID PATIENTS?

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Abstract: *Objective:* The aim of the study was to identify the most significant MNA-items to accelerate the determination of nutritional risk of elderly patients in routine clinical practice in a geriatric hospital. Since MNA requires 10-15 min it is hardly applicable to clinical routine. *Design:* The study was a cross-sectional study. Setting: The study centre was an acute geriatric hospital. Participants: In total 808 multimorbid elderly patients were recruited. Methods: We applied the MNA in 808 (528f/280m) geriatric multimorbid patients (78.5 ± 8.7f / 74.6 ± 9m yrs) without cognitive impairment 48h after hospital admission. Admission diagnoses covered orthopaedical (40%), internal (34%) and cerebrovascular (24%) diseases. According to analysis of reliability the consistency of the MNA scale for multimorbid patients has been verified. In preparation for scale reduction a factor analysis was applied. A reduced scale with selected cutoffs was configured and compared with MNA. *Results:* According to MNA, 15% of patients were well-nourished, 65% at risk of malnutrition and 20% were malnourished. The reliability analyses showed a Cronbach's Alpha of 0.60 that represented a satisfactory result. By means of factor analysis the MNA-items were reduced from 18 to 7 items (weight loss, mobility, BMI, number of full meals, fluid consumption, mode of feeding, health status). with new cutoffs (12.5-15 well-nourished, 9-12 at risk of malnutrition, <9 malnourished). According to the modified MNA (m-MNA) 21.7% of the patients were well-nourished, 54.5% at risk of malnutrition and 21.7% were malnourished. The score of the MNA and m-MNA correlated with r=0.910. Furthermore, there was a strong correlation between MNA and m-MNA group classification of 83%. *Conclusion:* The m-MNA enables a rapid (3min) and efficient screening of malnutrition in multimorbid geriatric patients. The m-MNA is easy to apply and may also be suitable in multimorbid patients with cognitive dysfunction. Due to the variety of items the m-MNA seems to be superior to other screening tools.

Key words: MNA, elderly, nutritional status.

Introduction

The prevalence of malnutrition in hospitalised multimorbid patients ranges from 10-85% (1-5). Especially for the elderly, an impaired nutritional status is a high-risk factor for mortality (5) and is associated with different diagnoses and geriatric syndromes i.e. frailty, depression, infection, sarcopenia, fractures (6,7).

It should be considered that there is no single independent parameter to identify malnutrition in multimorbid hospitalised patients. Furthermore, there is no general accepted screening or assessment tool available for the diagnosis of malnutrition in multimorbid hospitalised patients(8-10). In 2003 the European Society of Clinical Nutrition (ESPEN) recommended the Mini Nutritional Assessment (MNA) to assess nutritional status among the elderly (11). The MNA is a screening and assessment tool, that covers 18 items dealing with general, anthropometric, dietary and self assessment. It was developed by the study group of Guigoz et al. to evaluate the risk of malnutrition in the elderly patients in home-care programmes, nursing homes and hospitals (12). Even though the MNA was developed for fragile elderly patients, the MNA has been validated in a healthy geriatric population (12). In multimorbid geriatric patients the use of MNA is time-consuming, difficult to implement in patients with mild cognitive impairment or dementia and it is complex for routine clinical practice.

The aim of the study was to identify the most significant MNA-items to accelerate the determination of nutritional risk of elderly patients with and without cognitive dysfunction in routine clinical practice in a geriatric hospital.

Materials and Methods

Study population

Over a nineteen-month period from June 2004 to December 2005, 808 (528 female/280 male) multimorbid patients with acute medical condition were recruited 48h after hospital admission. Acute medical condition was defined as a condition of rapid onset, severe symptoms and brief duration. It also includes conditions resulting from chronic illnesses but which can be cured or substantially cured. Multimorbidity was defined as the co-occurrence of multiple diseases within a person. According to the International Classification of Diseases and Related Health Problems (ICD) patients with cognitive impairment / depression (i.e. mild cognitive impairment, vascular dementia, Alzheimer's disease, severe depression), not addressable patients and patients with lack of consent were excluded from the study. If in this cases the cooperation with

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patients' relatives was possible, data have been assessed in patients with cognitive impairment/depression, too.

The recruitment centre was the "Evangelisches Geriatriezentrum Berlin", Germany, a geriatric institution with 132 stationary beds. Patients had to be multimorbid and had to give their written informed consent. The study was approved by the ethics committee of the Charité – Universitaetsmedizin Berlin, Germany.

Nutritional status

Nutritional status was assessed by one trained investigator according to Mini Nutritional Assessment (MNA) and anthropometric measurement 48 hours after hospital admission. Body weight was measured in light indoor clothing without shoes with a seat scale (Seca, Hamburg, Germany) to the nearest 0.1 kg and height was measured with a stadiometer to the nearest 0.1 cm. Height of bedridden patients were estimated with knee-height measurement and calculated by Chumlea (13). It was measured in the supine position as the distance between knee and the foot basis, when the leg forms a 90° angle with the thigh.

The MNA covers 18 items dealing with anthropometric assessment (BMI, calf circumference, mid upper arm circumference), general assessment (medication, acute disease, cognitive impairment / depression, pressure ulcer, independent live), dietary assessment (number of meals, everyday consumption of protein-containing food, vegetables, fruits, beverages) and self assessment (consideration of health status, self view of nutritional status) (12). The nutritional status classification of the patient was carried out according to the scored number of points into categories of "well-nourished" (24 - 30 points), "moderately malnourished or at risk of malnutrition" (17 - 23.5 points) or "malnourished" (< 17 points).

Activities of daily living

The activities of daily living (ADL) were assessed by Barthel Index (BI). The first version of BI was developed by Mahoney and Barthel to measure the improvement of functional impairment during treatment und rehabilitation (14). The main aim is to establish the degree of independence from any help, physical or verbal, however minor and for whatever reason. The following items were assessed: bowel status, bladder status, grooming, toilet use, feeding, transfer, mobility, dressing, stairs and bathing. The BI includes 10 categories about self-supply and mobility. The score ranges between 0 and 100 points.

Statistics

Statistical tests and analyses were performed using SPSS software, version 12.0 (SPSS, Inc., Chicago, IL). Results were considered statistically different at the $p < .05$ and data were analysed by mean ± SD or median [Q1;Q3]. To identify differences of age, length of stay, activity of daily living, mobility and dementia/depression according to MNA a one-way analysis of variance and Bonferroni multiple comparison test was used. Significant differences are indicated in Table 1.

Correlation analyses of total MNA, Short-Form MNA and modified (m)-MNA scores were carried out according to Spearman's nonparametric test. The accordance of classification results of nutritional status based upon MNA and m-MNA scales was verified by using cross tabulation including the CHI_-test. The internal consistency of MNA scale was determined by a reliability analysis (Cronbach's Alpha). MNA scale reduction to m-MNA scale is based on the results of the procedure factor analysis (principal component analysis).

Results

Patient characteristics are listed in Table 1. All included patients were characterized by acute medical conditions and multimorbidity. Overall, 71.3% of patients had lived independently at home before hospitalisation; one third of them were bed or chair bound (33.3%) and one third of them were able to get out of bed/chair (34.8%). Admission diagnoses covered orthopaedical (40%), internal diseases (34%) and

Table 1
Subjects characteristic according to Mini Nutritional Assessment (MNA)

Portion of total sample	Well-nourished (24-30 points) 121 (15%)	Risk of malnutrition (17-23.5 points) 525 (65%)	Malnourished (<17 points) 162 (20%)	P
Gender (%female)	66.9	66.3	61.7	-
Age (years)	77.4 ± 8.6	77.3 ± 8.6	76.6 ± 9.5	NS
Length of stay (days)	16 [11;24]	19 [13;26]	22 [14;30]	0.012[a], 0.018[b]
Activities of daily living (points)	65 [45;80]	55 [35;70]	35 [15;55]	0.001[c]
Mobility (%)				
Goes out	62.8	31.4	5.8	30.5
Able to get out of bed/chair	36.2	33.3	13.6	32.7
Bed or chair bound	53.7	-	-	-

Results are expressed as mean ± standard deviation or median [Q1;Q3], a. MNA-A vs. MNA-C, b. MNA-B vs. MNA-C, c. comparison between all MNA-groups according to nonparametric Wilcoxon test

stroke (24%). Data of 18.2% of patients were assessed in cooperation with patients' relatives due to the cognitive impairment or depression.

According to the original cutoff point of the MNA, 15% of patients were well-nourished, 65% were at risk of malnutrition and 20% were malnourished. The mean age of included patients (77.1 ± 9.0 years) did not differ significantly between MNA-categories. Compared with malnourished patients the length of stays was significantly lower in well-nourished and risk patients. Nutritional status was significantly associated with activities of daily living (ADL) ($r = 0.307$, $p < 0.001$).

To identify the most efficient items for nutritional screening in multimorbid patients every single item of the 18 MNA items was documented for statistical analyses. In order to verify the consistency of MNA scale for multimorbid patients reliability analyses was performed. A Cronbach's Alpha of $a = 0.60$ represented a satisfactory result.

In preparation for scale reduction, a factor analysis was applied. In conclusion, seven items were identified from full MNA items: 1) anthropometry, 2) nutrition/self-view nutritional status, 3) mobility/independent living, 4) nutritional intake/weight loss, 5) medication/self view: health status, 6) psyche/pressure ulcer, 7) acute disease. According to this MNA-items were reduced from 18 to 7 items with the new cutoffs: well-nourished 12.5 – 15 points, at risk of malnutrition 9 – 12 points and malnourished <9 points. The seven items and their categories are presented in Table 2. According to that modified MNA (m-MNA) 21.7% of patients were well-nourished, 54.5% at risk of malnutrition and 21.7% were malnourished. As shown in figure 2 the correlation between MNA-sum and the sum of the reduced scale (m-MNA) was $r = 0.910$ ($p < 0.001$). Furthermore, there was a high accordance between MNA and m-MNA group classification of 83%. Random sample partition showed a good consistence and group classification results between sub and total sample.

Table 2
Reduced MNA scale with new cutoffs

MNA item	score
B Weight loss during the last 3 months	0 = weight loss greater than 3 kg 1 = does not know 2 = weight loss between 1 and 3 kg 3 = no weight loss
C Mobility	0 = bed or chair bound 1 = able to get out of bed/chair but does not go out 2 = goes out
F Body Mass Index (BMI) (weight in kg) / (height in m)^2	0 = BMI less than 19 1 = BMI 19 to less than 21 2 = BMI 21 to less than 23 3 = BMI 23 or greater
J How many full meals does the patient eat daily?	0 = 1 meal 1 = 2 meals 2 = 3 meals
M How much fluid (water, juice, coffee, tea, milk…) is consumed per day?	0.0 = less than 3 cups 0.5 = 3 to 5 cups 1.0 = more than 5 cups
N Mode of feeding	0 = unable to eat without assistance 1 = self-fed with some difficulty 2 = self-fed without any problem
P In comparison with other people of the same age, how does the patient consider his/her health status?	0.0 = not as good 0.5 = does not know 1.0 = as good 2.0 = better
Malnutrition score	
12.5-15-0 points	Well-nourished
9.0-12.0 points	At risk of malnutrition
<9.0 points	Malnourished

The evaluation of the m-MNA cutoffs results according to the MNA cutoffs.

Discussion

This study showed that especially the prevalence of the risk of malnutrition in multimorbid patients was high. Most former studies reported higher prevalence of malnutrition and well-nourished patients, but smaller fractions of risk patients (1,15-19). Poor recognition, a lack of monitoring nutritional status and / or inadequate intake of nutrients increase the prevalence of malnutrition (3,20). Furthermore, hospitalisation, functional and cognitive impairment, medical deterioration and social problems contribute to malnutrition (21). An impaired nutritional status is a high-risk factor for mortality (15) and is associated with different diagnoses and geriatric syndromes i.e. frailty, depression, infection, sarcopenia, fractures (6,7).

By means of factor analysis 7 of 18 MNA-items have been identified to be important parameters to screen and assess nutritional status in multimorbid patients (Table2):

BMI is the most utilised and popular parameter and component of nutritional screening due to its establishment in clinical routine and a significant independent index of obesity or underweight (22). The majority of screening tools includes BMI as the widely-accepted "gold-standard" indicator of malnutrition that reveals weight changes very quickly. We also find a significant correlation between BMI and MNA or m-MNA and therefore, and BMI is a first screening tool at hospital admission (15). Furthermore, Thomas et al. reported a linear increase of mortality: the lower the BMI, the greater the risk (15). The determination of BMI in bed-ridden geriatric patients is difficult due to a lack of a "bed balance" assessment. Furthermore, abnormally dehydrated lean body mass and adipose tissue in the elderly BMI lead to overestimate the number of well-nourished and underestimates the number of risk patients. However, the inclusion of BMI in the determination of nutritional status completes the screening

process and BMI is an indirect parameter to identify fat mass (23).

Weight loss is another risk parameter to identify malnourished patients (15). Unintended weight loss >10% in the last 6 months and >5% in the last 3 months respectively is associated with an adverse clinical process (24). But, it is unknown if weight loss is the consequence of malnutrition or if malnutrition is the consequence of weight loss. In this study 23.5% of the patients replied to this item with "weight loss unknown". The determination of weight is difficult due to bed-ridden patients and a lack of knowledge about body weight in the last 3-6 months. However, in a lot of disease patterns weight loss has been described as an independent risk parameter of malnutrition (25,26) and weight loss is a component in the majority of screening tools, too (11).

The activity of daily living was significantly reduced with impaired nutritional status. Malnutrition diminishes daily activities, quality of life, altered self-perception and decreased functional capacity. Especially elderly multimorbid patients are characterised by age-associated social isolation and altered health status (27). In this study 24.1% of the malnourished patients estimated health status as worse than patients at risk of malnutrition (11.8%) of the same age. It suggests that patients with an impaired nutritional status have the sensibility to detect their own health status and a subjective assessment is a good possibility to assess nutritional status (19). However, in very old patients that item is limited as a result of depression and cognitive impairment (28).

Malnutrition is characterized by an insufficient nutritional intake. It is caused by decreasing intake, malabsorption, excessive external losses or increasing requirements due to illness or medical treatment (3). The MNA-subscore of dietary habits relates specifically to the number of consumed meals, nutrients and problems with swallowing and digestion. According to Kagansky et al. dietary habits of MNA (number of meals, fluid intake, mode of feeding) correlated well with MNA-score (28). The assessment of dietary habits is important due to the reduced food intake and reduced appetite in multimorbid patients. In this study more than 90% of all patients were able to eat without assistance and ate three full meals daily. Jalali et al. reported that most of the elderly ate fewer than two meals a day, one half were unable to eat properly and one half ate fruit and vegetables (29). It shows that besides hospitalisation, restricted cognitive function (30) problems related to eating habits become more important with age (28). Furthermore, the dietary habits subscore of the MNA is a strong predictor of in-hospital and 3-year mortality (28). However, in patients with cognitive impairment and / or an impaired psychological state the evaluation of dietary habits are less accurate and less liable (28).

The decline in social and economic status, decline of weight, dysphagia and functional difficulties are results of cognitive impairment (31). But especially in patients with cognitive impairment or dementia the MNA cannot be used as a brief screening and assessment tool in daily routine clinical practice due to the complexity of MNA and the necessity of special training for several questions. Therefore, Rubenstein et al. developed the Short-Form Mini Nutritional Assessment (MNA-SF) that preserves diagnostic accuracy and minimizing time and training (32). The MNA-SF includes only six items and takes <5 minutes (32). The comparison between m-MNA and MNA-SF showed that the items "weight loss", "BMI" and "mobility" are identical. In that project the item "acute illness" was a constant item because all recruited patients were acute ill. It was possible to exclude that item. In this population the items "fluid intake", "mode of feeding" and "number of full meals" of the subscore "dietary assessment" were stronger than "loss of appetite" of MNA-SF. The advantage of the m-MNA in comparison to MNA-SF is that every item derives from every single MNA-subscore. Five of six items of MNA-SF derive from general and anthropometric assessment. In order to identify malnourished multimorbid hospitalised patients with acute disease it is necessary to use items of all four subscores of total MNA. Furthermore, according to the malnutrition cutoff "BMI <20 kg/m^2" the MNA and m-MNA identified the same portion of patients as malnourished or at risk of malnutrition. But in our population a smaller fraction of patients were identified as risk / malnourished patients according to SF-MNA (Table 3). However, BMI, activities of daily living (ADL) and length of stay (LOS) correlated with a comparable correlation coefficient between MNA, m-MNA and SF-MNA (Table 4). We analysed that the m-MNA is accurate, based on observation of the ROC curve and therefore, the m-MNA is a useful screening tool in multimorbid patients at hospital admission (Figure 1A).

Table 3
BMI <20 kg/m2 according to MNA, m-MNA and SF-MNA

	MNA	m-MNA	SF-MNA
Well-nourished (%)	3.2	2.3	3.2
At risk of malnutrition (%)	9.5	8.8	15.1
Malnourished (%)	39.5	39.1	

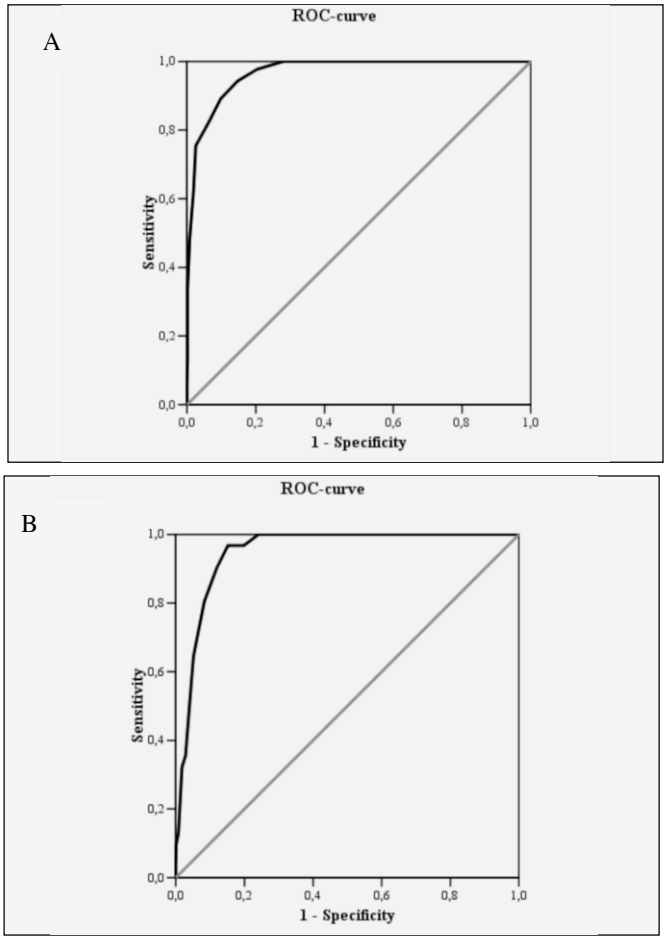
Table 4
Age, BMI, activity of daily living and length of stay by MNA, m-MNA and SF-MNA

	MNA		m-MNA		SF-MNA	
	r	p	r	p	r	p
Age	.023	NS	.044	NS	.007	NS
BMI	.391	< .001	.408	< .001	.429	< .001
ADL	.307	< .001	.318	< .001	.218	< .001
LOS	- .134	< .001	- .168	< .001	- .121	< .001

BMI Body Mass Index, ADL activities of daily living, LOS length of stay, r = Spearman correlation coefficient with significance lever p < .05

Figure 1

The MNA-category "at risk of malnutrition" and "malnourished" were considered as one group in comparison to the MNA-category "well-nourished". Receiver operating characteristics (ROC) of the sensitivity and specificity of predicted probability for the logistic m-MNA-score (A) as well as the Short-Form MNA (B) incorporate the total MNA-score. The area under the ROC curve (AUC) of the m-MNA (AUC = .968) was marginal better than the AUC of the Short-Form MNA (AUC = .948).



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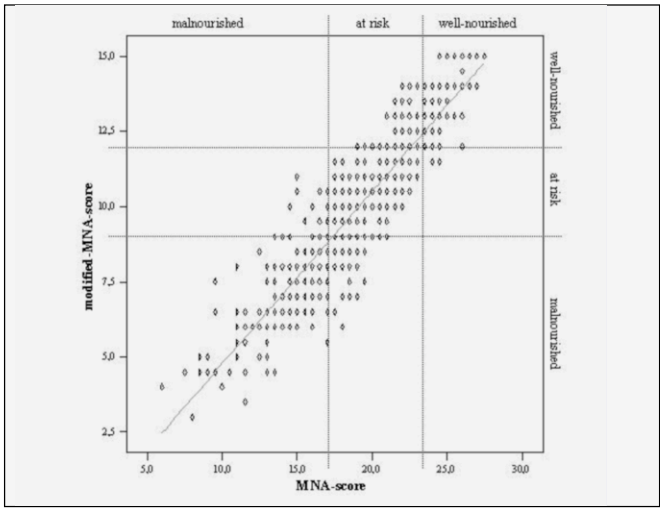
In conclusion, the determination of nutritional status in multimorbid and elderly patients is limited, due to cognitive impairment (17), frailty of patients, lack of sensitivity of malnutrition and time limitation in routine clinical practice (33,34). Even though the MNA is a useful instrument to identify elderly patients at risk of malnutrition (35) the m-MNA seems to be suitable in multimorbid geriatric patients with acute diseases and with cognitive dysfunction. With only seven questions from all four subscores it was possible to identify patients with malnutrition or at risk of malnutrition with a very strong correlation to total MNA. A further important advantage of the m-MNA is that six of seven items could reproduce from other geriatric assessments. Only one item (self view: health status) needs patient's cooperation. If a patient is non-complained the answer "does not know" can be used and nutritional status could determine without patients' cooperation. The results showed that the m-MNA allows a rapid and adequate screening to determine the nutritional status in multimorbid geriatric patients. Therefore, m-MNA is not time consuming (3 min maximum), easy to apply and may also be suitable in multimorbid patients with cognitive dysfunction. Further studies are needed to validate the m-MNA in a multimorbid population with cognitive impairment.

Figure 2

The modified MNA-score is strongly correlated with the full MNA-score ($r = 0.910$, $p < 0.001$)



References

1. McWhirter JP, Pennington CR. Incidence and recognition of malnutrition in hospital. BMJ 1994; 308(6934):945-8.
2. Clarke DM, Wahlqvist ML, Strauss BJ. Undereating and undernutrition in old age: integrating bio-psychosocial aspects. Age Ageing 1998; 27(4):527-34. Review.
3. Sullivan DH. The role of nutrition in increased morbidity and mortality. Clin Geriatr Med 1995; 11(4):661-74. Review
4. Marshall JA, Lopez TK, Shetterly SM et al. Indicators of nutritional risk in a rural elderly Hispanic and non-Hispanic white population: San Luis Valley Health and Aging Study. J Am Diet Assoc 1999;99(3):315-22.
5. Salva A, Corman B, Andrieu S et al. Minimum data set for nutritional intervention studies in elderly people. J Gerontol A Biol Sci Med Sci 2004;59(7):724-729.
6. Arellano M, Garcia-Caselles MP, Pi-Figueras M et al. Clinical impact of different scores of the Mini Nutritional Assessment (MNA) in the diagnosis of malnutrition in patients with cognitive impairment. Arch Gerontol Geriatr Suppl 2004;(9):27-31.
7. Gazzotti C, Arnaud-Battandier F, Parello M et al. Prevention of malnutrition in older people during and after hospitalisation: results from a randomised controlled clinical trial. Age Ageing 2003;32(3):321-325.
8. Jeejeebhoy KN. Nutritional assessment. Nutrition. 2000; 6(7-8):585-90. Review
9. Carney DE, Meguid MM. Current concepts in nutritional assessment. Arch Surg 2002; 137(1):42-5. Review.
10. Corish CA, Kennedy NP. Protein-energy undernutrition in hospital in-patients. Br J Nutr 2000; 83(6):575-91. Review.
11. Kondrup J, Allison SP, Elia M, Vellas B, Plauth M; Educational and Clinical Practice Committee, European Society of Parenteral and Enteral Nutrition (ESPEN). ESPEN guidelines for nutrition screening 2002. Clin Nutr 2003; 22(4):415-21.
12. Guigoz Y, Vellas B. Assessing the nutritional status of the elderly: The Mini Nutritional Assessment as part of the geriatric evaluation. Nutr Rev 1996;54(II):S59-

S65.
13. Chumela WC, Guo S. Equations for predicting stature in white and black elderly individuals. J Gerontol 1992, 47: M197-M203
14. Mahoney FI, Barthel DW. Functional evaluation: The Barthel Index. Md State Med J 1965;14:61-5
15. Thomas DR, Zdrowski CD, Wilson M et al. Malnutrition in subacute care. Am J Clin Nutr 2002;75(2):308-13.
16. Persson MD, Brismar KE, Katzarski KS, Nordenstrom J, Cederholm TE. Nutritional status using mini nutritional assessment and subjective global assessment predict mortality in geriatric patients. J Am Geriatr Soc 2002;50(12):1996-2002
17. Thorsdottir I, Jonsson PV, Asgeirsdottir AE et al. Fast and simple screening for nutritional status in hospitalized, elderly people. J Hum Nutr Diet 2005;18(1):53-60.
18. Van Nes MC, Herrmann FR, Gold G, Michel JP, Rizzoli R. Does the mini nutritional assessment predict hospitalization outcomes in older people? Age Ageing 2001;30(3):221-6.
19. Vellas B, Guigoz Y, Garry PJ et al. The Mini Nutritional Assessment (MNA) and its use in grading the nutritional state of elderly patients. Nutrition 1999; 15(2):116-22. Review.
20. Prevost EA. Butterworthe CE Jr. Nutritional care of hospitalised patients. Am J Clin Nutr 1974;27:432. Abstract.
21. Morley JE, Kraenzle D. Causes of weight loss in a community nursing home. J Am Geriatr Soc 1994;42(6):583-5.
22. Corish CA, Kennedy NP. Anthropometric measurements from a cross-sectional survey of Irish free-living elderly subjects with smoothed centile curves.Br J Nutr 2003;89(1):137-45.
23. Cook Z, Kirk S, Lawrenson S, Sandford S. Use of BMI in the assessment of undernutrition in older subjects: reflecting on practice. Proc Nutr Soc 2005;64(3):313-7. Review.
24. Klein S, Kinney J, Jeejeebhoy K, Alpers D et al. Nutrition support in clinical practice: review of published data and recommendations for future research directions. Summary of a conference sponsored by the National Institutes of Health, American Society for Parenteral and Enteral Nutrition, and American Society for Clinical Nutrition. Am J Clin Nutr 1997;66(3):683-706. Review.
25. Andreyev HJ, Norman AR, Oates J, Cunningham D. Why do patients with weight loss have a worse outcome when undergoing chemotherapy for gastrointestinal malignancies? Eur J Cancer 1998;34(4):503-9.
26. Schols AM, Slangen J, Volovics L, Wouters EF. Weight loss is a reversible factor in the prognosis of chronic obstructive pulmonary disease. Am J Respir Crit Care Med 1998;157(6 Pt 1):1791-7.
27. Dormenval V, Budtz-Jorgensen E, Mojon P, Bruyere A, Rapin CH. Associations between malnutrition, poor general health and oral dryness in hospitalized elderly patients. Age Ageing 1998;27(2):123-8.
28. Kagansky N, Berner Y, Koren-Morag N et al. Poor nutritional habits are predictors of poor outcome in very old hospitalized patients. Am J Clin Nutr 2005;82(4):784-91.
29. Jalali R. Examining the aged's nutritional condition in Kermanshah Iran, 2003. Asia Pac J Clin Nutr 2004;13(Suppl):S113.
30. Odlund Olin A, Koochek A, Ljungqvist O, Cederholm T. Nutritional status, well-being and functional ability in frail elderly service flat residents. Eur J Clin Nutr 2005;59(2):263-70.
31. Niskanen L, Piirainen M, Koljonen M, Uusitupa M. Resting energy expenditure in relation to energy intake in patients with Alzheimer's disease, multi-infarct dementia and in control women. Age Ageing 1993;22(2):132-7.
32. Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for undernutrition in geriatric practice: developing the short-form mini-nutritional assessment (MNA-SF). J Gerontol A Biol Sci Med Sci 2001;56(6):M366-72.
33. Christensson L, Unosson M, Ek AC. Evaluation of nutritional assessment techniques in elderly people newly admitted to municipal care. Eur J Clin Nutr 2002;56(9):810-8.
34. Seiler WO. Clinical pictures of malnutrition in ill elderly subjects. Nutrition 2001;17(6):496-8. Review.
35. Ruiz-Lopez MD, Artacho R, Oliva P et al. Nutritional risk in institutionalized older women determined by the Mini Nutritional Assessment test: what are the main factors? Nutrition 2003;19(9):767-71.