Mini Nutritional Assessment (MNA): Research and Practice in the Elderly
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Introduction to
the New Nestlé Clinical & Performance
Nutrition Workshop Series

In 1997, Nestlé created the Nutrition Strategic Business Division (NSBD) in order to centralise and enhance its specific competence in nutrition. Thus, five departments compose this division. Infant and Child Nutrition covers normal and disease related nutrition for this age group. Clinical Nutrition is responsible for enteral nutrition and supplements in order to prevent and treat malnutrition in specific target groups. Performance Nutrition deals with all aspects of “functional food” for children, selected groups of adults and the senior population. Nestlé Nutrition Communication is responsible for providing updated information on nutritional issues within and outside the Company. Finally, the medical/scientific group co-ordinates world-wide research and development in the field of nutrition, clinical studies and scientific information, among these the Nestlé Nutrition Workshops.

Since the well-established Nestlé Nutrition Workshop Series was, until now, aimed at infant nutrition only, we decided to organise other workshops aimed towards adult nutrition. The first Nestlé Clinical and Performance Nutrition Workshop took place last October in Lausanne, Switzerland and we are pleased to present this first booklet, of a hopefully long lasting series, covering the subject of malnutrition.

Prevention and treatment of malnutrition is the important goal in clinical nutrition. Early and precise diagnosis of malnutrition is essential in order to initiate nutritional therapy as soon as possible.

Only during the acute phase of disease are patients kept in hospital, where experts in the field of diagnosis and treatment of malnutrition are available. During the rehabilitation phase, malnourished elderly patients are often treated at home or in nursing homes, where the quality of nutritional support depends on the knowledge of the attending physician or dietician. In elderly persons “without overt disease”, low degree malnutrition is often overlooked and no therapy is offered.

The interactions between malnutrition of the elderly, on the one hand, and altered immunity, increased morbidity and mortality, on the
other hand, are well documented. The “Mini Nutritional Assessment” procedure is a diagnostic tool which can be easily handled by general practitioners, dieticians and nursing personnel. It is not time-consum- ing and does not require sophisticated equipment to perform.

Therefore, its broad application could assist in the prevention and early treatment of malnutrition and, thus, allow elderly people to ben- efit from improved health enabling them to take full advantage of their “best years”.

Prof. Ferdinand Haschke, MD
Vice-president
Nestec Ltd., Vevey, Switzerland
Foreword

It has been known for many decades that even in the most affluent countries elderly people admitted to hospital for acute medical or surgical diseases or accidents usually undergo progressive impairment in their nutritional status [1, 2], which remains unnoticed for variable periods. When the medical staff diagnose protein-energy malnutrition, it is often late and may be difficult to correct.

Until 1994, only specialized units in the most advanced geriatric centers were using sophisticated measurements to assess malnutrition and to follow progress during realimentation [3, 4]. The criteria used in different centers were not always the same, making comparison between centers difficult. Moreover the techniques used were specialized and not applicable on a large scale in most geriatric centers, which do not have research personnel among their staff.

Since the beginning of the 1990s, Vellas, Garry, Guigoz and Albarede have developed and validated the Mini Nutritional Assessment (MNA) [5], which is easy, quick, and economical to perform and enables staff to check the nutritional status of elderly people when they enter hospitals or institutions, and to monitor changes occurring during their stay. This allows the necessary nutritional measures to be applied sooner, to prevent a further decline in nutritional status or to restore it to normality.

MNA also allows one to compare the prevalence of protein-energy malnutrition in various centers, and more importantly to compare nutritional measures and protocols used in these centers.

Nestlé Clinical Nutrition is very proud to have supported the development and evaluation of MNA for many years and to have been instrumental in promoting this new and indispensable tool for the better care of the elderly. The MNA Symposium will mark an important step in broadening the use of the MNA tool in its various applications.

Franck Arnaud-Battandier, Medical Director

Pierre Guesry, Vice-President Research
References

The Mini Nutritional Assessment (MNA) for Grading the Nutritional State of Elderly Patients:
Presentation of the MNA, History and Validation

Yves Guigoz and Bruno Vellas

The prevalence of malnutrition reaches significant levels (15-60%) in elderly patients who are in hospital, who live in nursing homes, or who are in home care programs [1, 2] (Fig. 1). The aim of the Mini Nutritional Assessment (MNA) is to evaluate an individual's risk of malnutrition so as to permit early nutritional intervention when necessary [3]. The development, validation, and cross-validation of this nutritional assessment test was a collaborative research program between the Departments of Internal Medicine and Clinical Gerontology, Toulouse University Hospital, France, the Clinical Nutrition Program, University of New-Mexico, USA, and the Nestlé Research Center, Lausanne, Switzerland. Overall, the populations studied represent the whole spectrum of elderly subjects (n > 600), ranging from very active healthy old people to frail house-bound individuals and those institutionalized for dementia. The developmental study (Toulouse 91) was done to test the MNA, and the second study (Toulouse 93) was used to validate it. The study on healthy elderly people (Albuquerque 93) was used to evaluate the potential of the MNA in a healthy population and to validate it in a different cultural context.

The MNA test is composed of simple measurements and brief questions that can be completed in about 10 minutes. These are: Anthropometric measurements (weight, height, and weight loss); Global assessment (six questions related to lifestyle, medication, and mobility); Dietary questionnaire (eight questions related to number of meals, food and fluid intake, and autonomy of feeding); and Subjective assessment (self perception of health and nutrition).
The sum of the MNA score distinguishes between the following groups of elderly patients: (a) those with adequate nutritional status: MNA ≥24; (b) those at risk of malnutrition: MNA between 17 and 23.5; and (c) those with frank malnutrition: MNA <17. With this scoring, sensitivity has been found to be 96%, specificity 98%, and predictive value 97% for malnutrition, taking the clinical status as reference (Toulouse 91).

The MNA can assess the risk of malnutrition in elderly people before clinical changes occur. It is a useful tool for physicians to make rapid and reliable evaluation of elderly patients as part of a comprehensive geriatric assessment and to recognize early risk situations.

References
Assessing nutritional status in the elderly is critical in determining health status. Poor nutritional status is related to increased morbidity, and malnutrition is associated with an increased incidence of morbidity and mortality [1]. In addition, nutritional status is related to the overall quality of life and health. The MNA is a practical, non-invasive technique for rapidly evaluating potential risk of malnutrition in the elderly [2]. This instrument has received recognition as a suitable screening tool and has been validated to a limited degree in various samples of elderly persons from around the world [3]. However, the relation of the MNA scores to actual measures of body composition – that is, fat-free mass (FFM), total body fat (TBF), and per cent body fat (%BF) – has not been addressed. In this report, we examine the correlation between MNA scores in healthy adults and measured body composition indices. If the MNA is to be a truly useful nutritional assessment tool, then it should be clearly related to body stores of fat and protein.

The study sample included 24 men and 37 women, aged 20 to 78 years. These were healthy, free-living persons who were participants in Health Assessment 2000, a National Institutes of Health funded study of multifrequency bioelectrical impedance at Wright State University School of Medicine. The MNA was administered by a trained health researcher, and the answers recorded on a laptop computer. Individual values for body composition were obtained from dual energy \( \chi \) ray absorptiometry (DXA) using a Lunar DPX machine with 3.6z software. In the sample, there were seven men and seven women with MNA scores between 20 and 24, which are within the proposed range for risk of malnutrition (17 to \( \leq 24 \)). The remaining 77% of the sample had MNA scores of 25 or more, indicating they were well nourished.

The ages of the seven women were between 40 and 70 years, but three of the men were younger than 40 years and the remaining four were between 50 and 60 years. Means for measures of FFM, TBF, %BF,
and calf circumference, and for calculated values of body mass index (BMI) for the 14 men and women at risk for malnutrition were not different from corresponding means for the 47 well nourished men and women (Table I). Thus approximately 23% of our sample were identified as at risk of malnutrition, but their body composition was similar to that of the sample identified as well nourished.

Table I – Univariate statistics for body composition and anthropometric variables by MNA classification.

<table>
<thead>
<tr>
<th>Variable</th>
<th>MNA &lt;24</th>
<th>MNA ≥24</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td></td>
<td>Men (n = 6)</td>
<td></td>
</tr>
<tr>
<td>FFM (kg)</td>
<td>64.5</td>
<td>6.1</td>
</tr>
<tr>
<td>TBF (kg)</td>
<td>23.9</td>
<td>10.0</td>
</tr>
<tr>
<td>%BF</td>
<td>26.3</td>
<td>7.9</td>
</tr>
<tr>
<td>CC (cm)</td>
<td>39.4</td>
<td>2.9</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>27.1</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>Women (n = 4)</td>
<td></td>
</tr>
<tr>
<td>FFM (kg)</td>
<td>43.7</td>
<td>2.8</td>
</tr>
<tr>
<td>TBF (kg)</td>
<td>29.5</td>
<td>12.3</td>
</tr>
<tr>
<td>%BF</td>
<td>38.9</td>
<td>9.0</td>
</tr>
<tr>
<td>CC (cm)</td>
<td>39.9</td>
<td>5.4</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>27.2</td>
<td>7.6</td>
</tr>
</tbody>
</table>

%BF, per cent body fat; BMI, body mass index; CC, calf circumference; FFM, fat-free mass; TBF, total body fat.

Our findings suggest that the current version of the MNA may have limitations in its sensitivity and specificity owing to this apparent categorization of healthy individuals as at risk for malnutrition. Additional studies are needed clarify the sensitivity and specificity of the MNA in relation to measured values of body stores of fat and protein for individuals.

This work was supported by grants HL53404, HD27063 and HD 12252 from the National Institutes of Health, Bethesda, MD, USA.

References
MNA and Immunity: Nutritional and Immunologic Markers in the Elderly

E. J. Schifffrin, Y. Guigoz, G. Perrusseau, Y. Delneste, R. Mansourian, B. Vellas, A. Blancher

A lowered immune response has been reported in elderly people [1]. This impaired response may be associated with the normal aging process, with chronic pathological conditions, or with malnutrition. Malnutrition may be a frequent finding (15-60%) in the elderly population in hospitals or living in nursing homes [2]. Therefore the early detection of malnutrition and its correction could be a useful means of preventing terminal infectious events in the aging population.

The MNA is a valuable tool recently developed to assess the risk of malnutrition in the elderly. The aim of our study was to determine whether there is a correlation between the MNA score or other nutritional markers and various immunologic indices in the elderly. The study took place in Toulouse (Centre de Médicine Gériatrique), and involved 88 nursing home patients who were classified according to their MNA score into three groups: group 1, MNA score ≥24: adequate nutritional status; group 2, MNA score between 17 and 23.5: at risk of malnutrition; and group 3, MNA score <17: malnutrition. Seventy nine patients completed the immunologic study.

The immune indices studied were: (a) determination of serum immunoglobulins (IgG, IgM, IgA); (b) immune response against an *Streptococcus pneumoniae* vaccine; (c) determination of lymphocyte differential counts with flow cytometry for the following subsets: T cells (CD3+), activated T cells (CD3+/CD25+), helper T cell (CD4+), suppressor/cytotoxic T cells (CD8+), naive and memory T cells (CD45 RA and CD45 RO), and B cells (CD19); (d) *in vitro* lymphocyte functional assays (proliferation assays with mitogens; cytokine and cytokine receptor assays in cell culture systems after mitogen stimulation).

**Results**

No significant lymphopenia was observed in any of the groups. There were significant differences in hemoglobin and hematocrit
between the well nourished and the malnourished groups \((p<0.05,\ ANOVA\ on\ ranks\ test)\), and there were reduced numbers of CD8+ lymphocytes in the anemic group. However, overall no association was shown between nutritional status as defined by MNA, albumin or anemia and lymphocyte counts.

No differences were found in serum IgG and IgM concentrations between the three MNA categories, but there was a higher concentration of serum IgA in the malnourished group \((p<0.05,\ ANOVA)\). When patients were divided into anemic and non-anemic groups there was a trend for the anemic patients to have a higher IgA.

Interleukin-2 (IL-2) specific mRNA appeared higher in the well nourished category than in the other categories. Although this did not quite reach significance \((p = 0.06)\), the trend was striking. This suggests that the diminished IL-2 production previously reported in the elderly [3] could be linked to nutritional status.

Conclusion

Although the population of elderly people included in this study showed markers of malnutrition, this was not sufficient to alter immune system homeostasis. Detection of malnutrition by MNA seems to anticipate other biochemical markers of malnutrition and indicate a population at risk, before the physiology of the immune response is profoundly altered.

References

Comparative Nutrition Evaluation with MNA and NuRAS

P. OSTER, U. VELTE, B. M. ROST AND G. SCHLIERF

The aim of this study was to compare MNA with another form of nutritional assessment, NuRAS (nutritional risk assessment scale), which was developed in our hospital [1]. We also looked at nutritional interventions that resulted from the two assessments. Fifty geriatric patients were studied.

Both scales ask questions about the general physical and psychological situation, appetite, loss of weight, difficulties in eating, and digestion problems. In NuRAS, questions on drugs and medication include cigarette and alcohol consumption. NuRAS also asks about the social situation. In the MNA, nutritional habits are evaluated by questions on the number of meals per day, the selection of food, and the fluid intake. In the MNA, anthropometric variables are used to describe the nutritional status of the patient, while in NuRAS a subjective rating is used [2]. The MNA also contains questions about patients’ self-assessment of their nutritional status.

With NuRAS the scale rating is simply the number of identified risk factors; with the MNA a score is calculated, indicating either good nutritional status, risk for malnutrition, or poor nutritional status. The correlation of the results between the two forms of assessment was high (Fig. 1). The greatest variability was seen in the intermediate (risk) zone of the MNA. As every risk factor may have consequences, the calculation of a score does not seem advisable. The number of possible nutritional interventions was greater with the MNA, mainly because of the questions about nutrition habits.

The section of the MNA involving anthropometric assessment is in our view too complicated and could be substituted by the simpler clinical judgment. We found that if simple subjective judgment was plotted against total points of the MNA, all patients classified as cachectic by a physician had an MNA score of less than 17 – that is, they were in the malnourished MNA score class.
Interventions resulting from either form of assessment should be effective and ideally should be followed by improved scores, leading to a better quality of life for the geriatric patient.

References


Odor perception declines with age, while diminished odor perception is associated with poor general health, malnutrition and various diseases [1, 2]. Food flavors consist mainly of volatile odors, and flavor perception has been rated as the strongest determinant of food choice in the elderly [3]. The interactions of these various factors are shown in Fig. 1. Enriching food by flavors to compensate for diminished odor perception may therefore improve consumption of particular foods and prevent malnutrition.

In the first part of the study, we explored which age-associated factors such as poor oral health, body composition, diminished odor perception, and poor general health are accompanied by an increased risk of malnutrition, measured by the MNA. In the second part, we tested whether increasing the flavor level of food improves food preference and consumption of elderly people at risk of malnutrition.

**Methods**

We recruited 67 elderly persons living in the community (mean age 66.7 years, SD 6.8, range 55-82) and 81 persons in retirement homes (mean age 82.7 years, SD 7.2, range 61-98). Odor perception was
measured by the detection threshold for isoamylacetate (fruity banana/pear odor), and persons were partitioned into those taking medication affecting odor perception, other medication, or no medication. Oral examinations were carried out and the MNA was used to evaluate the risk of malnutrition. General health status was determined by the Medical Outcome Study (MOS) scores and anthropometric measures to assess the distribution of fat and muscle.

Skimmed yogurt with strawberry flavor was chosen as the food for flavor amplification (Perlarom S.A., Belgium). To measure preference for a high or low flavor level, each subject received two food samples (20 g) at the same time, one containing high strawberry flavor level, the other low flavor level. These yogurt dishes were supplied between the meals for 2 days. Portions were large to ensure ad libitum consumption and were weighed before and after the session to measure quantities consumed.

Results

Only 2% of elderly people in the community were at risk, compared with 37% in retirement homes. Overall, there was a significant correlation between risk of malnutrition and poor odor perception ($p < 0.001$). For elderly people living both in the community and in retirement homes, general health and body composition were important factors ($p < 0.005$), while in retirement homes, the number of natural teeth and use of medication were significant factors in explaining the risk of malnutrition measured by the MNA score ($p = 0.001$).

Elderly persons preferring the high strawberry flavor level had significantly lower MNA scores ($t$ test, $p < 0.05$). Significant correlations were observed between consumption of low flavor level yogurt and MNA score ($r = 0.26$, $p = 0.001$), indicating that elderly people at risk of malnutrition consume less of the low flavor product. No significant correlation was observed between consumption of high flavor yogurt and MNA score ($r = 0.13$, $p = 0.054$).

Conclusions

Elderly people at risk of malnutrition tend to have worse health, poorer odor perception, fewer natural teeth, and more often use drugs affecting odor perception than elderly people who are not at risk of malnutrition. Elderly people suffering from malnutrition might benefit from flavor amplification of food since this improves food preference. With no added flavor, a low MNA score is associated with a diminished consumption of food; with flavor amplification, consumption remains constant when the MNA score becomes low. Flavor amplification is necessary to optimize food intake in elderly people suffering from mal-
References

The MNA Score in Successfully Aging Persons

K. Scheirlinckx, A. S. Nicolas, F. Nourashemi, B. Vellas, J. L. Albarède, P. J. Garry

Successful aging for people reaching retirement is one of the main objectives of gerontologic medicine. We need to study subjects who are aging successfully to gain a better understand of the aging process and the differences between normal, pathologic, and successful aging, a distinction proposed by Rowe and Khan in 1987 [1]. Many studies have tried to describe, characterize and define this age group and so establish the predictive factors for a successful aging process, enabling these to be promoted by suitable interventions.

The relation between nutritional status and aging has been a subject of growing interest, and knowledge of the nutritional intake and needs of the elderly population has increased greatly in recent years. The MNA is a standardized and validated tool which rapidly determines the nutritional status of patients and the risk of malnutrition. We analyzed the MNA score in a population of 330 elderly persons from the New Mexico Aging Process Study. All these people were volunteers, independent, living in their home, and recognized as being in good health after a medical examination.

Table I – Comparison of nutritional variables in subjects in excellent/good health status versus frail/sick health status.

<table>
<thead>
<tr>
<th></th>
<th>Excellent/good n = 238 (72%)</th>
<th>Frail/sick n = 92 (28%)</th>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>75.7</td>
<td>80.1</td>
<td>$p = 0.0001$</td>
</tr>
<tr>
<td>MNA (max 30)</td>
<td>27.0 ± 2.1</td>
<td>25.4 ± 2.4</td>
<td>$p = 0.0001$</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>25.2</td>
<td>25.2</td>
<td>NS</td>
</tr>
<tr>
<td>Albumin (g/l)</td>
<td>41.2 ± 2.5</td>
<td>40.7 ± 2.1</td>
<td>NS</td>
</tr>
</tbody>
</table>

Values are means ± SD. BMI, body mass index; MNA, Mini Nutritional Assessment.
A four stage classification that defines the state of health of the elderly was used, involving general physical examination, functional assessment, history of disease, and biological indices. This distinguished people who are very healthy, healthy, frail, or sick. We found that the MNA increased in parallel with health status. Better nutritional status was found in subjects aging successfully than in the other groups, as expected, and their MNA scores were well above 24, which is the threshold for risk of malnutrition. The mean MNA score was 27.7 ± 1.8 for the people in very good health. Table I shows that MNA, but not body mass index and plasma albumin, distinguished between subjects in good/excellent health and those who were frail/sick.

Up to now, we have considered that an MNA score above 24 reflected good nutritional status in the general population. From our observations in the present study, we now believe a score of 27/30 should be the reference value for successful aging.

Reference
Anorexia of Aging: Leptin and the MNA

J.E. Morley, D.K. Miller, H.M. Perry, Y. Guigoz and B. Vellas

Food intake decreases over the life span [1]. This is accompanied by an increase in body mass index in middle age and a decrease in older persons. The anorexia of aging is produced by multiple factors in response to the decrease in metabolic rate and physical activity that occurs with aging. Peripheral factors resulting in a decrease in food intake with aging include a decrease in the relaxation of the fundus of the stomach associated with decreased nitric oxide activity and an increase in the levels and effectiveness of cholecystokinin. Centrally, there is a decrease in the opioid feeding drive.

MNA and leptin

A hormone called leptin, produced by fat cells, has recently been characterized [2]. This hormone is an excellent proxy for fat mass in females. In older males, the decrease in testosterone leads to an increase in leptin despite loss of fat mass. Leptin appears to play a role in fat cell activation, insulin resistance and possibly fat cell distribution. We found that plasma leptin concentration was strongly correlated with the MNA in females, but not in males – presumably because of the effect of testosterone.

MNA and SCALES

We examined the relation between two nutritional screening indices, MNA and the St. Louis University nutrition screen, SCALES, in an inner-city American population. The two indices were well correlated ($r = -0.457$, $p < 0.0001$), and were predictive of poor functional status (including activities of daily living, quality of life, a seven item physical performance test, and the geriatric depression scale).

Conclusions

MNA is an excellent predictor of nutritional status. Our findings suggest that malnutrition is a major predictor of frailty or the “failure to thrive” syndrome in older persons.
References


Associations Between the MNA Instrument, Dehydration, and Functional Status Among Older African Americans in St. Louis, Missouri, USA

D.K. MILLER, H.M. PERRY AND J.E. MORLEY

MNA has been shown to represent nutritional status [1], but its relations to dehydration and the adverse consequences of dehydration are unclear. Since dehydration results in poor function in older individuals [2], we designed a study to examine the association between MNA, dehydration, and functional status in elderly people.

Methods

We studied 127 African Americans aged 71 years and older from an inner city area of St. Louis. The MNA was closely approximated, although no fluid intake data were available, and had a maximum of 27.5 points. Dehydration was measured by the blood urea nitrogen to creatinine (BUN/Cr) ratio, 18 representing the upper limit of normal. Functional status was measured using basic activities of daily living (BADL), intermediate activities of daily living (IADL) and the Rosow-Breslau scale (physical disability). We also recorded the geriatric depression scale (GDS) for an assessment of affect; the mini-mental state examination (MMSE) for cognition; one-leg stand time and Guralnik's score for balance; timed “Up and Go” for mobility; and seven item physical performance test (PPT) of Reuben and Siu, for integrated timed physical performance. Quality of life (QOL) was measured by Spitzer's Uniscale.

Results

Diminished nutritional status as measured by the MNA correlated poorly with BUN/Cr ratio \( r = -0.15, p = 0.14 \). Positive correlations of the full MNA with functional status included the following: ADL,
\( r = -0.24, \ p = 0.008; \) IADL, \( r = -0.31, \ p = 0.0004; \) Rosow-Breslau, \( r = -0.41, \ p = 0.0001; \) GDS, \( r = -0.49, \ p < 0.0001; \) PPT, \( r = 0.21, \ p = 0.017; \) and QOL, \( r = 0.26, \ p = 0.004. \) Correlations with MMSE, one-leg stand, Guralnik, and “Up and Go” were not significant. Results were essentially identical using a dichotomized MNA. Dehydration correlated with all dependent variables (except for MMSE) and especially strongly with balance variables, followed by physical disability scales, “Up and Go,” and PPT.

**Conclusions**

In this sample, a somewhat modified version of the MNA was weakly associated with dehydration (perhaps due partly to lack of hydration questions in our MNA) and variably associated with the adverse functional consequences of dehydration, suggesting that its current structure may include primarily risk factors for poor nutrition and few risk factors for dehydration *per se*.

**References**


Impaired nutritional status is common in patients with Alzheimer disease [1]. Weight loss increases with the severity of the disease [2]. Impairment of feeding behavior occurs in the late stages of dementia [3]. With this background, we measured nutritional status in patients with Alzheimer disease using the MNA test. The patients were either living at home (participants in a longitudinal study, ELSA) or were inpatients in a hospital acute care unit.

### TABLE I – Weight loss in Alzheimer disease patients in relation to MNA and nutritional indices.

<table>
<thead>
<tr>
<th>Weight loss &gt;4%:</th>
<th>At entry</th>
<th>At 1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No (n = 42)</td>
<td>Yes (n = 34)</td>
</tr>
<tr>
<td>MMS</td>
<td>16.2±6.0</td>
<td>13.4±7.1*</td>
</tr>
<tr>
<td>MNA</td>
<td>24.0±2.3</td>
<td>24.7±2.0</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>61.4±13.0</td>
<td>62.5±13.0</td>
</tr>
<tr>
<td>Intake (kcal)</td>
<td>2013±652</td>
<td>1909±473</td>
</tr>
<tr>
<td>CRP (mg/l)</td>
<td>4.4±4.3</td>
<td>4.1±3.7</td>
</tr>
<tr>
<td>Albumin (g/l)</td>
<td>44.9±4.0</td>
<td>43.3±4.6</td>
</tr>
<tr>
<td>Weight loss &gt;10%:</td>
<td>No (n = 42)</td>
<td>Yes (n = 10)</td>
</tr>
<tr>
<td>MMS</td>
<td>16.2±6.0</td>
<td>12.7±6.0*</td>
</tr>
<tr>
<td>MNA</td>
<td>24.0±2.3</td>
<td>23.8±7.0</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>61.4±13.0</td>
<td>59.3±14.0</td>
</tr>
<tr>
<td>Intake (kcal)</td>
<td>2013±652</td>
<td>1941±482</td>
</tr>
<tr>
<td>CRP (mg/l)</td>
<td>4.4±4.3</td>
<td>5.8±6.5</td>
</tr>
<tr>
<td>Albumin (g/l)</td>
<td>44.9±4.0</td>
<td>40.1±5.0</td>
</tr>
</tbody>
</table>

Values are mean ± SD. CRP, C reactive protein; MMS, Mini-Mental State assessment; MNA, Mini Nutritional Assessment.

*p <0.05; **p <0.01
**Longitudinal study**

We followed 76 patients in the ELSA study, 34 (44%) of whom had a weight loss of more than 4% of their body weight over one year. Ten of these 34 subjects lost more than 10% of their body weight. The MNA score of these 10 subjects decreased from 24 ± 7 (at entry to the study) to 21 ± 3 one year later (Table I). Eating behavior as evaluated by the Blandford scale in the ELSA population [3] showed that a low MNA of between 17 and 23.5 was correlated with impairment of eating behavior – that is, the need to be fed intermittently, failure to eat without coaxing, use of fingers instead of utensils.

**Hospital sample**

In 118 Alzheimer disease hospital inpatients in an acute care unit, the mean MNA score was low, at 19 ± 4.9.

**Conclusions**

Nutritional screening and nutritional intervention are likely to be important in improving the quality of life and decreasing morbidity in Alzheimer disease patients.

**References**


MNA and Cancer

G. ZULIAN

Cancer is one of the leading causes of death worldwide. Diet is the second risk factor for cancer next to age but before tobacco [1]. Correction of nutritional deficits has been shown to decrease the incidence of some cancers in China [2]. In addition, vegetarians in the United Kingdom are apparently less likely to die of cancer than meat eaters [3]. Finally, dietary intervention may improve the prognosis of women with breast cancer [4]. Nutritional assessment is thus considered of great importance in the management of cancer patients at every stage of the disease.

MNA in cancer patients

In 1996, 2890 patients were admitted to the department of geriatrics of Geneva University Hospitals. MNA assessment was done by the receiving physician in the admission ward. The original MNA has 18 items divided into global evaluation, diet indications, subjective evaluation, and anthropometric measurements. The assessment was slightly adapted to conform to our local practice.

Of 442 MNA forms returned (15.5% of all admissions), 387 were fully completed (13.4%). Of 607 patients with cancer (21% of admissions) identified in the 1996 database, 71 (11.7%) had an MNA (with 58 forms being fully completed); these were compared with 371 non-cancer patients (329 forms fully completed). Cancer diagnoses were: prostate (n = 13), breast (n = 10), hematologic malignancies (n = 10), gastrointestinal tract (n = 9), brain (n = 6), skin (n = 8), respiratory tract (n = 5), urinary tract (n = 5), uterus (n = 2), and others (n = 3).

MNA score was 19.07 ± SD 3.89 in cancer patients and 20.21 ± 4.13 in non-cancer patients. These values were not statistically different by ANOVA (p = 0.0521).

Comment

In this group of elderly patients referred to a geriatric hospital, MNA was inconsistently completed. This may suggest lack of compliance and perhaps reluctance on behalf of both patients and doctors to take
enough time to properly address the questions. The help of the family
or proxies may be required to obtain appropriate answers and this was
not always available. Data are thus incomplete but nevertheless show
the extent of the heterogeneity of patients and diagnoses. The absence
of any difference in MNA score between cancer patients and non-cancer
patients is an indication of the general condition of our population.
Future studies on MNA and cancer are necessary to explore this area
further. They should be carried out by experienced clinicians for prog-
nostic and therapeutic purposes in the admission ward or in the out-
patient department, both at diagnosis and on relapse.

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MNA and Geriatric Assessment

LAURENCE Z. RUBENSTEIN

Comprehensive geriatric assessment has become established as central to the care of elderly persons [1]. It is a multidimensional, interdisciplinary diagnostic process to determine a frail elderly person's medical, psychosocial, and functional capabilities and problems, in order to develop an overall plan for treatment and long term follow-up.

Its effectiveness in achieving improved care outcomes when employed in overall geriatric care programs has been well documented [2]. The major domains of comprehensive geriatric assessment include medical conditions, functional status, psychological variables, and socio-environmental adequacy.

Among the most important of the medical domains is nutritional status, because of its well known relation to other clinical outcomes and its amenability to treatment; yet it has been among the least widely studied. There has been great need to develop and validate useful screening and assessment instruments for nutrition to be used in the comprehensive geriatric assessment process.

Nutritional deficiency is a common and serious problem in the elderly population. It seems obviously important to detect both overt malnutrition and risk for undernutrition in the course of performing comprehensive geriatric assessment. The need for both screening instruments and more definitive assessment tools is clear, and the MNA fulfills many criteria for both types of measures. It was developed and validated on large representative samples of elderly persons, and has been shown to be clinically useful. On the other hand, its relatively long length – as compared with other brief assessment measures – may impede its acceptance as a screening tool in situations where the comprehensive geriatric assessment must be both brief and inclusive of multiple domains. Thus a short-form version of the MNA (MNA-SF) would seem to be a worthwhile goal.

We have attempted to produce such a version using a step-wise simplification process, trying to retain questions of highest estimated importance, ease of data collection, inter-rater reliability, and correlation with both the total MNA score and with clinical judgment and objective
measures of nutritional status. Our intent was to preserve predictive accuracy while minimizing the time and training needed to administer the screen. We used the same population database (n = 155) on which the MNA was originally developed and tested. The resultant MNA-SF has six questions (as compared to the original 18) with a score range of 0 to 14, and it eliminates many of the most time consuming items (for example, anthropometric measurements). It has a high correlation with both the full MNA ($r = 0.969$) and with objective measures of nutritional status such as albumin. Moreover, using a cut point of 10/14, it has a sensitivity of 97.9%, a specificity of 100%, and an overall predictive accuracy of 98.7% for predicting malnutrition, using the full MNA as the gold standard.

It appears that the MNA-SF may be a useful screening tool for use in the initial comprehensive geriatric assessment, especially in relatively healthy populations. This can then be supplemented by the full MNA or additional specific tests for persons identified as having possible nutritional problems to help confirm the diagnosis and plan specific treatment.

References
Aging and malnutrition are both well known surgical risk factors [1, 2], but no studies on malnutrition in surgical geriatric patients have used the MNA. We therefore undertook a descriptive survey assessing the amount of malnutrition in elderly surgical patients, using the MNA. The elderly people evaluated were outpatients over 60 years of age receiving routine preoperative evaluation at two sites: a university affiliated public hospital (Centre Hospitalier Universitaire de Nîmes, Nîmes, France), and a private surgical hospital (Clinique Beau Soleil, Montpellier, France). We did not assess hospital inpatients (though institutionalized patients seen as outpatients were included), or patients admitted for emergency surgery.

The MNA was used for the assessment of nutritional status by the anesthesiologist seeing the patient for preoperative evaluation. It was included in the overall clinical assessment summarized using the American Society of Anesthesiologists (ASA) physical status score. Gender, age, body mass index (BMI), and type of scheduled operation were also recorded.

Patients

Data were recorded on 419 patients (50.4% women) seen between January and October 1996. Their median (range) age and BMI were 72 (60 to 98) years and 25.2 (12.8 to 40.0) kg/m², respectively. In all, 191 patients were seen in Montpellier and 228 in Nîmes; 263 patients (62.8% of the total) were seen before gastrointestinal surgery, 95 (22.7%) before orthopedic surgery, 28 (6.7%) before digestive tract endoscopy, and 33 (7.9%) for miscellaneous reasons.

Results

The median MNA score was 26, ranging from 1.5 to 30. Twenty eight patients (6.9% of the total) were found to suffer from frank malnutrition (score <17), 104 (25.5%) were at risk of malnutrition (between
17 and 23.5), and 276 (67.6%) were well nourished. Among 290 ASA grade 1-2 patients (low and minor risk for anesthesia and surgery), 24.8% were found to be at least at risk of malnutrition, compared with 118 ASA grade 3-4 (high risk) patients, in whom 49.1% were at risk or frankly undernourished. From comparison with other studies, it seems that surgical patients over 60 are most at risk of malnutrition. There was a close relation between the ASA and MNA scores, but the ASA score alone could not predict malnutrition. However, since about half of the ASA grade 3-4 patients were at least at risk of malnutrition, the ASA score could be used to screen surgical patients with regard of their nutritional status.

Conclusions
The MNA seemed useful for the preoperative evaluation of nutritional status. Its effectiveness may best be judged from clinical studies relating the MNA score to the postoperative course of elderly patients.

References
Frail elderly people are at increased risk of malnutrition [1, 2] but precise nutritional assessment is difficult in everyday clinical practice. A brief nutritional assessment test such as the MNA [3] would be an effective way of screening patients who are undernourished. However, there is an important variability in the elderly population, so we need to know the characteristics of the assessment tools used in clinical practice in each type of population. Our aim in this study was to investigate the behavior of the MNA in three different samples of elderly people: nursing home, convalescence geriatric unit, and at home.

Methods

A descriptive analysis of each group was made.

Other variables included in the study were: the activities of daily living (ADL), evaluated through the Katz scale; the cognitive impairment (only in the community-based study), measured through the Pfeiffer’s test; and finally, the anthropometric variables were measured as basic indicators of the nutritional status: (weight, height and body mass index (BMI)), weight loss during the last three months and serum albumin.

The Spanish version of the MNA was obtained after translating the French original version and after its verification through the translation-retrotranslation method carried out by bilingual person [4]. The MNA was administered by the nurses, who were previously trained.

The study populations were as follows: nursing home: includes those people who were in the Nursing Home of Saint Joseph in Mataró in 1995, n = 87, 69 women and 18 men, mean ages 83.3 (SD 8.2) and 78.8 (SD 9.5) years respectively. They suffered no acute disease at the moment of the evaluation. Convalescence geriatric unit: includes those people admitted during 1995, n = 114, 62 women and 52 men, mean ages 78.5 (SD 8.4) and 77.1 (SD 10.8) years respectively. They are people in a subacute phase of a disease or in a rehabilitation process. At home: is a representative sample of those people aged between
65 and 85 years old, who live independently in our city of Mataró, n = 199, 114 female and 85 male, mean ages 72.75 (SD 5.5) and 71.45 (SD5.1) years respectively.

The results of the MNA are presented in three categories. The other remaining variables are presented as percentages, means and standard deviations. Linear associations between total MNA scores and the other variables were analysed by the Spearman correlation coefficient.

**Results**

MNA score results are given in Table I. In the nursing home, 63% were independent in 5 or 6 activities of daily living. 11.5% of the subjects had a BMI lower than 21 and 73.6% higher than 23. 84% of the patients had an albumin level higher than 35 gr/l, 15% between 30 and 35, and 1% lower than 30 gr/l. Total MNA score was correlated with serum albumin in men and in women >79 years old, body mass index (BMI), weight loss, and the Katz index (activities of daily living). In the convalescence geriatric unit only 18.4% where independent for the ADL. 24.4% of the subjects had a BMI lower than 21, 57.0% higher than 23. 47% had an albumin level higher than 35 gr/l, 33% between 30 and 35, and 20% lower than 30. MNA scores showed a high correlation with BMI, weight loss, and the Katz index, but only a weak correlation with albumin. In the community all of them were independent in performing the ADLs and made less than 3 mistakes in the Pfeiffer’s test (since they were criteria for inclusion in the study)1.5% of the subjects had a BMI lower than 21 and 95% of them had a BMI higher than 23.

Table I – MNA results in the difference categories of elderly patients.

<table>
<thead>
<tr>
<th></th>
<th>Nursing home n = 89</th>
<th>Convalescent unit n = 114</th>
<th>At home n = 199</th>
</tr>
</thead>
<tbody>
<tr>
<td>MNA malnourished</td>
<td>5.7%</td>
<td>33.3%</td>
<td>0.5%</td>
</tr>
<tr>
<td>MNA at risk</td>
<td>47.1%</td>
<td>54.4%</td>
<td>9.5%</td>
</tr>
<tr>
<td>MNA normal</td>
<td>47.1%</td>
<td>12.3%</td>
<td>89.5%</td>
</tr>
</tbody>
</table>

**Conclusions**

The MNA is an easy and relatively quick nutritional assessment tool in geriatrics. Results are very different depending on the population studied. The MNA can discriminate the nutritional status according with the most basal nutritional parameters. The nutritional status measured by the MNA is correlated with the activities of daily living.
References


MNA and Nutritional Intervention

F. Arnaud-Battandier, S. Lauque, M. Paintin, R. Mansourian, Y. Guigoz, B. Vellas

Malnutrition is a frequent finding in the elderly population in hospitals [1], in nursing homes [2], and at home [3], but is not generally diagnosed. Using the MNA, a program of oral nutritional intervention was implemented.

A clinical randomized study was performed in 10 nursing homes in Toulouse. The aim was to determine whether a nutritional intervention could modify the MNA score, prevent weight loss, and thereby improve biological markers of nutritional status. Eighty-seven patients (13 men and 74 women) were distributed according to the MNA score in four groups: group A (MNA score ≥ 24; well nourished), groups B and C (MNA score between 17 and 23.5; at risk of malnutrition), and group D (MNA score < 17; frank malnutrition). Groups C and D were supplemented with products specifically designed for oral nutrition.

Four products with a range of three flavors each were offered to these patients. They were sweet or savory, liquid or creamy products enriched with protein, vitamins, and minerals. Three were selected by the patient, allowing an additional energy intake of 300-500 kcal/day.

The study period was 60 days, and dietary intakes (assessed from a three-day diary), anthropometry, MNA, and biological measurements were performed at entrance (day 0) and at the end of the study (day 60). Dietary intakes and body weight were also recorded at mid-study (day 30).

Of the 87 patients, 78 completed the study (group A, n = 19; group B, n = 22; group C, n = 14; group D, n = 23); four patients from group D (malnourished) died; 5 were excluded for adverse events. Oral supplementation was well accepted by all subjects.

Results

Daily nutrient intakes were unchanged between day 0 and day 60 in groups A and B (29 ± 1.5 to 27 ± 1.8 kcal/kg/d in group A; 31 ± 1.4 to 31 ± 1.7 kcal/kg/d in group B). In group C the intake increased from 29 ± 1.7 to 34 ± 2.0 kcal/kg/d. In group D it increased from 34 ± 1.3 to
$43 \pm 1.6$ kcal/kg/d. The increased intake in group D was associated with an increase in mean MNA score from 13.9 to 17.1 and a significant increase in weight ($p < 0.001$).

Conclusions

Nutritional supplements significantly increase nutrient delivery and allow weight gain in malnourished patients. Improvement in MNA scores suggest that the MNA can be used as a follow up tool after nutritional intervention.

References

MNA and Cost of Care

P. Quadri, C. Fragiacomo, W. Pertoldi, Y. Guigoz, F. Herrmann, Ch. H. Rapin

Nutritional deficiency in the elderly often influences their clinical condition, increasing mortality, morbidity, and length of hospital stay [1, 2]. Medical treatment is an important factor in the cost of care.

The aim of this study was to evaluate the MNA in elderly hospital inpatients and to draw attention to the possible relation between MNA score and the cost of care and length of stay in hospital.

Methods

We recruited 166 elderly patients, mean age 81.1 ± 5.9 years (103 females and 63 males). They were consecutively admitted to the department of geriatric medicine of the Mendrisio Regional Hospital between September 1994 and April 1995. None of the subjects had dieted before the study, or had diseases affecting nutritional status.

The indices used to assess nutritional status were body mass index (BMI), MNA (Italian translation), and plasma albumin and prealbumin (by nephelometry). Statistical analysis was carried out by analysis of variance with Bonferroni correction, by the $\chi^2$ test, and by Fisher’s exact test.

Results

Nutritional screening assessed by MNA classified 15% of subjects as malnourished ($n = 25$), 32.5% as at risk of malnutrition ($n = 54$), and 52.5% as well nourished ($n = 87$).

The cost of care and hospital length of stay are considered for two groups of patients: group A, well nourished, and group B, malnourished. These are shown in Table I.

Conclusions

MNA scores of <17 were associated to higher costs of care and a longer length of stay in hospital. MNA allows a quick assessment of the nutritional status; this simple instrument is a potential predictor of hospital length of stay and total costs. Early screening for nutritional
status could reduce health costs in geriatric medicine by allowing rapid realimentation.

**TABLE I – Costs of care and length of hospital stay in group A (well nourished) and group B (malnourished).**

<table>
<thead>
<tr>
<th></th>
<th>Cost ($US)</th>
<th>Length of stay (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group A</td>
<td>Group B</td>
</tr>
<tr>
<td>MNA ≥24</td>
<td>7 299</td>
<td>&lt;17 11 173</td>
</tr>
<tr>
<td>BMI (g/m²) ≥23</td>
<td>8 114</td>
<td>&lt;23 8 844</td>
</tr>
<tr>
<td>Alb (g/l) ≥35</td>
<td>7 707</td>
<td>&lt;35 9 818</td>
</tr>
<tr>
<td>Prealb (g/l) ≥0.2</td>
<td>7 726</td>
<td>&lt;0.2 9 254</td>
</tr>
</tbody>
</table>

Alb, plasma albumin; BMI, body mass index; MNA, Mini Nutritional Assessment; prealb, plasma prealbumin.

References

Agenda
of the 1st Nestlé Nutrition Workshop:
Clinical & Performance Programme

“Mini Nutritional Assessment (MNA) in the Elderly:
Research and Practice”

Chairmen: Prof. P. J. Garry
Dr. Y. Guigoz
Prof. B. Vellas
Lausanne, Switzerland, 7-8 October 1997

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State of Elderly Patients: Presentation of MNA, History, Validation
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The MNA and Body Composition in Healthy Adults
W. CAMERON CHUMLEA, GWENDOLYN HALL, FLAVIUS LILLY,
R.M. SIERVOGEL AND SHUMEI S. GUO

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in the Elderly
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GINO VERLEYE, INGRID PONJAERT-KRISTOFFERSEN, DESIRE L. MASSART

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J.L. ALBARÈDE, P.J. GARRY

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J. E. MORLEY, D.K. MILLER, H.M. PERRY, Y. GUIGOZ AND B. VELLAS
Associations Between the MNA Instrument, Dehydration, and Functional Status Among Older African Americans in St. Louis, Missouri, USA
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Gilbert Zulian

MNA and Geriatric Assessment
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The MNA in Preoperative Nutritional Evaluation: A Study on 419 Elderly Surgical Patients
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The MNA in Clinical Practice
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MNA and Nutritional Intervention
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MNA and Cost of Care
P. Quadri, C. Fragliacomo, W. Pertoldi, Y. Guigoz, F. Herrmann, Ch. H. Rapin

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