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**RESEARCH ARTICLE**

# Validity assessment of MNA among an elderly population in Kerala,South India.

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## *Abstract*

Statistics point to the fact that the central challenge of the growing elderly population is indeed their health. A growing body of evidence suggests that there are nutritional components to many of the health problems and preventive nutrition strategies may play a significant role in chronic conditions which do affect independence, quality of life and health care expenditure.Though anthropometric and biochemical measurements are usually performed to define the type and severity of malnutrition, there is no generally accepted 'gold standard' for diagnosis of geriatric malnutrition .In this context the present study was carried out with the following specific objectives as to define the nutritional status of the elderly using a comprehensive approach including anthropometry, biochemical and clinical assessments . Also a global tool for assessment of nutritional status of elderly,the Mini Nutritional Assessment (MNA) tool was also used. Using clinical status of subjects as 'gold standard', the MNA demonstrated a sensitivity of 90.2% percent and specificity of 96.4% percent in identifying well nourished and malnourished elderly, which is excellent. Use of BMI as a 'gold standard' also showed that MNA had excellent sensitivity (95.4 %) and specificity (93.9%) in identifying malnutrition. It was concluded that MNA is able to classify the elderly as well nourished and malnourished with reasonable accuracy. The feasibility of use of the MNA tool in routine geriatric assessments in the study region is acceptable and MNA is therefore recommended for use in the study region.
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## INTRODUCTION

A grey wave is rapidly setting on the world with the rate of growth of aging population exceeding that of the general population. What was an extra ordinary achievement for the last century will be one of the greatest challenges for the present one – ensuring quality of life of an exceptionally large elderly population (World Health Organization, 2000). The proportion of elderly is rising more rapidly in developing countries than in developed ones. WHO projections (2002) indicate that by the year 2020, more than 70 percent of the world's elderly people will be in developing countries, with the absolute numbers exceeding 700 million compared to 318 million in developed regions.

India has nearly seven percent of its total population shuffling across the line that defines the elderly with seventy six million aged above sixty (Census Report, 2001). By 2016, it is expected to rise to 114 million constituting 8 to 9 percent of the total population. The Indian aged population is currently the second largest in the world to that of China leading with 100 million elderly. The life expectancy at birth which was 70 years in 1990 is projected to reach 82 years by 2020 (IIPS,2009). From 1961 to 2011, there has been a 200 percent increase in the population of older adults in India.

Statistics point to the fact that the central challenge of the growing elderly population is indeed their health. A growing body of evidence suggests that there are nutritional components to many of the health problems and preventive nutrition strategies may play a significant role in chronic conditions which do affect independence, quality of life and health care expenditure. Thus, the inseparable triad of nutrition, aging and health seems to be the logical basis for appropriate management of problems of the old that arise due to a host of inter dependent factors.

Assessment of nutritional status of elderly necessitates use of a valid, simple and easy to use screening tool .However,Use of a valid and reliable tool to assess nutritional status of elderly has been absent in most geriatric assessment programmes. Though anthropometric and biochemical measurements are usually performed to define the type and severity of malnutrition, there is no generally accepted 'gold standard' for diagnosis of geriatric malnutrition .In this context, WHO has stressed the need to assess the validity of already developed tools rather than going for detailed procedures in developing an entirely new tool. Mini Nutritional Assessment (MNA), a tool developed by the Nestle Research Centre, Switzerland in 1994 has been reported to be a simple and effective tool for geriatric nutritional assessment (Sergi et al., 2006., Thorsdottir et al., 2005., and Christenson, 2002). The MNA fulfilled criteria like sensitivity, specificity, cost and targeting of a specific group. Since it was freely available and composed of simple measurements and brief questions, the MNA was selected as a suitable tool for geriatric nutritional assessment. More over the MNA has been validated on elderly people ranging in age from 65 to 90 years and the very frail to very active (Guigoz et al., 2002).

So the applicability of Mini Nutritional Assessment tool in the study locale (Kochi, Kerala) has been attempted. The main intention was to study the feasibility of use of MNA tool in nutritional studies of elderly to define precisely whether the screening tool is able to identify malnutrition.The specific objective of the study was to assess the validity of the non-invasive tool, Mini Nutritional Assessment (MNA),among the selected group of elderly .

**MATERIALS AND METHODS**

Two stage cluster sampling was adopted for the selection of free living and institutionalized subjects from Kochi, Kerala, South India. Inclusion criteria for selecting elderly were deemed to be persons above 60 years of age, free from apparent terminal illnesses or psychological abnormalities. A total of five hundred subjects were interviewed regarding collection of background information, psychological status, functionality , dietary intake and morbidity profile. Further detailed nutritional assessments were carried out on subsamples of subjects who volunteered for the same and attended the medical camps organized.

In the present attempt, the following assessments were chosen to test the applicability of the MNA in identifying malnutrition.

1)**Clinical Assessment** using a subjective assessment of nutritional status by two qualified physicians (n=166) on a subsample of 166 elderly including freeliving (n=85) and institutionalized (81) who were subjected to detailed clinical examination by qualified physicans. The clinical Assessment Schedule developed by National Advisory Committee – Indian Council of Medical Research (N.A.C- I.C.M.R) as given by Swaminathan (2003) was used.

2) **Anthropometry** Body mass Index(n=296), Mid Upper Arm Circumference (n=296)and Calf Circumference (n=296) . Height and Weight measurements of both free living and institutionalized elderly were taken, observing the techniques suggested by WHO (1995). From the recorded height and weight values , BMI values were computed for 296 elderly .The cut off points for BMI suggested by Shetty and James (1994) and James et al.,(1988) was used to classify the elderly into different grades of nutritional status.

Mid Upper Arm Circumference (MUAC) is recognized to indicate muscle development. It is simple, easily accessible and is practical to measure. It has been reported to correlate well with weight, height and clinical signs. Calf circumference(CC) is considered to provide the most sensitive measure of muscle mass in the elderly and is superior to arm circumference. Calf circumference is also an indicator of muscle development as the adipose tissue is evenly distributed around the area. WHO (1995) suggested calf circumference along with MUAC as an indicator of protein malnutrition as it indicates the changes in fat free mass that occur with ageing and decreased activity The MUAC and CC of 296 subjects, including both free living and institutionalized elderly, were measured using the technique described by WHO (1995).

3) **Biochemical indices** Serum albumin (n=125), Haemoglobin (n=180), Haematocrit (n=125) and Total Cholesterol(n=125).
. Serum Albumin was determined on a subsample of 125 elderly subjects, 60 men and 65 women, of free living and institutionalized category. The Biuret and BCG methods were employed in the assessment of Serum albumin .

- Haemoglobin estimation was done on a subsample of 180 subjects (72 elderly men and 108 elderly women) byCyanmetheamoglobin method.
- PCV was determined as part of analysis of Complete Blood count of 125 subjects determined by diluent technique using haematology auto analyser BC 3000, MINDRAI, of Agappe diagnostics.
- Blood cholesterol level is also an important biochemical parameter especially in association with chronic diseases like coronary heart disease, obesity etc. It is used for screening primary and secondary hyperlipidemias. Total cholesterol was estimated on 125 elderly by CHOD- PAP method.

4) **MNA assessment** was done on 296 elderly, including free living and institutionalized sample. Mini nutritional assessment (MNA) is a screening tool designed to provide rapid assessment of nutritional risk (Guigoz et al.,2002) and is composed of four domains ; anthropometry, dietary ,global and subjective assessments . It fulfilled the criteria of a tool for nutritional evaluation like sensitivity, specificity , cost and targeting a specific group (Rush,2004). It has been translated by specialists into more than 15 languages and is freely available.

Cross tabulations of the MNA results to the selected markers of nutritional status and further sensitivity-specificity analysis was done to evaluate its feasibility of use.

## RESULTS AND DISCUSSION:

On the basis of detailed clinical evaluation using the ICMR schedule without knowledge of MNA results, two clinicians, trained in nutrition, classified the patients as well nourished or under nourished. This classification was used as 'Gold standard' to evaluate the MNA and is further named as Clinical status. Using clinical status as the standard, the elderly (n=166) were classified as well nourished (51%) and under nourished (49%). The Mean Body Mass Index of elderly classified so is given below :

**Table 1:Mean BMI of Elderly subjected to Clinical evaluation**

| **Particulars** | | ***Clinical status*** *(n=166)* | |
|---|---|---|---|
| | | **Well nourished 51% (n=84)** | ***Mal nourished 49% (n=82)*** |
| **Mean BMI** (n=166) | Men (n=61) | 23.4± 3.54 | *18.4± 2.94* |
| | *Women (n=105)* | *24.8 ±3.70* | *19.8 ±3.83* |

The above results indicate that the Body Mass Index (an indicator of long term mal nutrition) varied within the subjects classified as well nourished or malnourished. This indicates that clinical status is of value in testing the applicability of MNA.

The following table shows the classification matrix of MNA vs. clinical status, taken as 'Gold standard'.

**Table 2: Classification Matrix: MNA vs Clinical Status**

| **Nutritional Status as per MNA (n=166)** | **'Gold Standard' Clinical Status(n=166)** | |
|---|---|---|
| | **Well nourished (n=84)** | **Mal nourished (n=82)** |
| Well nourished (n=89) MNA score ≥ 24 | 81 | ***8*** |
| Mal nourished (n=77) MNA score ≤ 23.5 | ***3*** | 74 |
| Sensitivity – 90.2%<br>Specificity – 96.4% | | |

Out of 166 subjects only twelve subjects (indicated in italics) were misclassified by MNA scores, indicating that the MNA is able to classify the nutritional status of subjects with accuracy. The sensitivity ie., the ability to identify all actual positives (in this case malnourished) by the tool, with respect to their clinical evaluation by physicians was 90.2%, which is excellent. The specificity ie., the ability to recognize all actual negatives ( in this case well nourished ) was 96.4%, which indicates that the MNA is able to identify well nourished elderly with slightly better accuracy than it is able to identify malnourished older persons.

The agreement between Body Mass Index and MNA in classifying the nutritional status of the elderly was also tested by sensitivity- specificity analysis as given below.

**Table 3:Classification Matrix: MNA vs Body Mass Index**

| **Nutritional status as per MNA (n=296)** | **Body Mass Index (n=296)** | |
|---|---|---|
| | **Well nourished BMI ≥20 (n=163)** | **Mal nourished BMI≤ 20 (n=133)** |
| Well nourished (n=159) MNA score ≥ 24 | 153 | ***6*** |
| Mal nourished (n=137) MNA score ≤ 23.5 | ***10*** | 127 |
| Sensitivity – 95.4%<br>Specificity – 93.9% | | |

Body Mass Index less than 20 is suggested as a cut off point indicating low body weight further leading to several grades of chronic energy deficiency (BMI <18.5) among vulnerable groups in developing countries (Expert consultation of WHO,2004). Therefore, a Body Mass Index less than 20 was used as the cut off for classifying the elderly as well nourished or malnourished. In this analysis only 16 elderly (given in italics) out of 296 subjects were misclassified by MNA scores. The sensitivity (95.4%) and specificity (93.9%) co-efficients were excellent, indicating the applicability of MNA in identifying malnutrition among the elderly in Kochi.

Equivalent cut offs in relation to and chronic energy deficiency using a range of data sets from developing countries have been developed by James et al., (1994). Ismail (1990) reported cut off value of 21.7cm in relation to BMI cut off of 16kg/$m^2$ for elderly. Webb and Copemann (1996) suggested a Mid Upper Arm cut off value of less

than 22cm to indicate increased risk of malnutrition . Using the MUAC cut of value 22 cms, the applicability of MNA was assessed as given below.

**Table 4:Classification Matrix : MNA vs. Mid Upper Arm Circumference**

| **Nutritional status as per MNA (n=296)** | **Mid Upper Arm Circumference (n=296)** | |
|---|---|---|
| | **Well nourished (>22 cm) (n=263)** | **Mal nourished (<22 cm) (n=33)** |
| Well nourished (n=159) | 156 | ***3*** |
| Mal nourished (n=137) | ***107*** | 30 |
| Sensitivity – 90.9%<br>Specificity – 59.3% | | |

On using Mid Upper Arm Circumference as per standard, the MNA was quite accurate in predicting mal nutrition and therefore showed high sensitivity coefficient (90.9%).However, the MNA misclassified 107 subjects with MUAC above 22cm as malnourished and therefore its specificity (power of identifying true well nourished subjects) was found to be 59.3 percent only.

Association of MNA scores to calf circumference cut off values as proposed by Bonnefoy et al., (2002) and Ismail (1999) were studied and is presented in the following table.

**Table 5:Classification Matrix: MNA vs Calf Circumference**

| **Nutritional status as per MNA** (n=296) | **Calf circumference** (n=296) | |
|---|---|---|
| | **Well nourished (>31 cm) (n=112)** | **Mal nourished (<31 cm) (n=184)** |
| Well nourished (n=159) | 110 | ***49*** |
| Mal nourished (n=137) | ***2*** | 135 |
| Sensitivity – 73.4%<br>Specificity –98.21% | | |

The MNA showed average sensitivity (73.4%) in recognizing malnutrition in conjunction with calf circumference measurements. But the specificity (ie. power of identification of well nourished elderly) of the tool was found to remarkably high (98.21%) on comparing with calf circumference measurements. This means that the elderly who were having low calf circumference values (< 31 cm) were misclassified as well nourished by the MNA.

The conclusions derived from the above analyses may be summarized as below:

**Table 6:Summary of sensitivity and specificity tests of MNA**

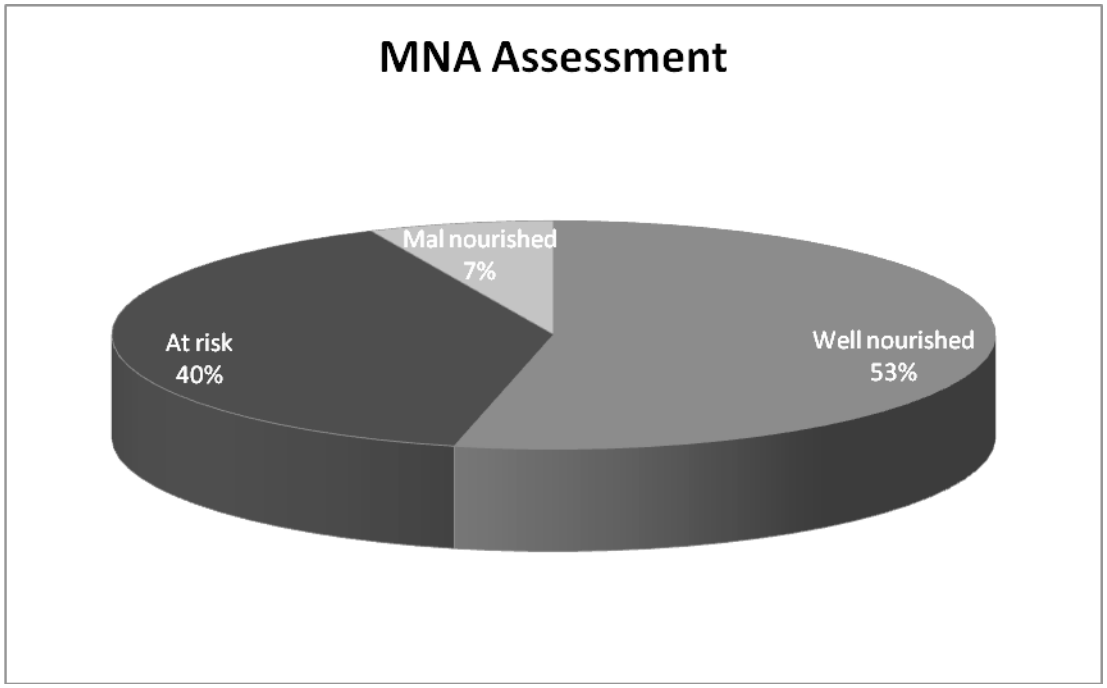
| Standards to which compared | Sensitivity of MNA (power to identify true malnourished* ) | Specificity of MNA (power to identify true well nourished**) |
|---|---|---|
| Clinical Status as per physicians | 90.2%-Good | 96.4%-excellent |
| Body Mass Index | 95.4% - -excellent | 93.9%-excellent |
| Mid Upper Arm Circumference | 90.9%-excellent | 59.3%-average |
| Calf Circumference | 73.4%-fair | 98.21%-excellent |

*True malnourished -malnourished as per the standards used.
**True well nourished -well nourished as per the standards used

It is clear from the above table that the MNA is able to classify the elderly as well nourished and malnourished with reasonable accuracy. Therefore the feasibility of use of the MNA tool in routine geriatric assessments in the study region is acceptable.

Nutritional status assessment by MNA score revealed that more than half of elderly (53.6%) were well nourished, followed by 'at risk' elders (39.6%) and malnourished (6.8%). (Figure 1)

**Figure 1 - Distribution of elderly according to Grades of Nutritional Status as per MNA**



The present study is fairly consistent with the reports of Christensson et al., (2002) and Guigoz et al., (2003) that on using MNA scores, a considerable proportion of elderly were at risk of malnutrition. On using MNA assessment, 48 percent and 45 percent of elderly to be 'at risk' of malnutrition were reported by Soini et al (2004) and Visvanathan and Mcintosh (2003) respectively. The percentage of elderly who were malnourished ranged from 3 to 3.8 percent only in the above studies. Ferdous et al., (2009) in Bangladesh applied the MNA and found 26 percent to be malnourished and 62 percent to be at risk. In Spain (Cuervo, 2009), 4.3 percent were undernourished as per the MNA.

## CONCLUSIONS:

Using clinical status of subjects as 'gold standard', the MNA demonstrated a sensitivity of 90.2% percent and specificity of 96.4% percent in identifying well nourished and malnourished elderly, which is excellent. Use of BMI as a 'gold standard' also showed that MNA had excellent sensitivity (95.4 %) and specificity (93.9%) in identifying malnutrition. With respect to Mid Upper Arm Measurements, the sensitivity of MNA was only 90.9% percent whereas the specificity was average (59.3%).The sensitivity of MNA was found to be fair (73.4 %) on using calf circumference as the gold standard. However the specificity of the tool was rated highest (98.21%) in this analysis. Association of selected biochemical indices with MNA scores were checked. The mean values of serum albumin progressively declined with poorer MNA scores, the association being significant ($p<0.01$). It was also found that haemoglobin and haemotocrit values were also significantly associated ($p<0.05$) with MNA scores. Nutritional status assessment by MNA score revealed that more than half of elderly (53.6%) were well nourished, followed by 'at risk' elders (39.6%) and malnourished (6.8%).

Thus it was concluded that MNA is able to classify the elderly as well nourished and malnourished with reasonable accuracy. The feasibility of use of the MNA tool in routine geriatric assessments in the study region is acceptable and MNA is therefore recommended for use in the study region.

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