Original Article

Assessment of the Missing Link between Nutritional Status, Functional Capacity and Morbidity Profile in the Community-dwelling Geriatric Population of a District of Eastern India

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Abstract

Background : Aging presents significant challenges for older adults, increasing their vulnerability to malnutrition due to various factors. Poor nutritional status is often associated with reduced functional ability, which can lead to higher rates of illness and mortality. Early detection of malnutrition risk can improve their autonomy and overall health, ultimately enhancing their Quality of Life.

Aims and Objectives : This study aims to explore the relationship between nutritional status and measures of functional ability and morbidities among the elderly.

Materials and Methods : A cross-sectional study was performed involving 210 elderly individuals from Bankura district in West Bengal, employing a 30-cluster sampling method. Three standardized tools were used: the Mini-Nutritional Assessment – Short Form (MNA-SF), the Katz Index of Independence in Activities of Daily Living (Katz ADL), and the Cumulative Illness Rating Scale-Geriatric (CIRS-G). Data analysis included Chi-square tests, independent t-tests, and one-way ANOVA for mean comparisons.

Results : The study examined 210 elderly individuals, with a mean age of 72.1±6.6 years. Among them, 18.6% were classified as malnourished, while 50% were identified as being at risk of malnutrition. There was a significant association between MNA-SF Indicators of Nutritional Status with Katz ADL Categories and CIRS-G Indicators of Morbidity.

Conclusion : The nutritional status of the elderly population significantly influences their functional capabilities and morbidity profiles. Considering this fact, conducting regular nutritional risk assessments in healthcare settings can help identify at-risk individuals early, allowing for prompt interventions. Regular screening and cost-effective interventions may combat the public health challenge of geriatric malnutrition.

Key words : Old Age, Nutritional Status, Functional Capacity, Morbidity, India, Public Health.

The progress in technology, expanded educational access, the empowerment of women, and economic development has all played a significant role in demographic transition. This transition is marked by a concurrent decline in both birth and death rates, leading to elevated dependency ratios. Such transformations are an inevitable result of demographic transition, which every country must confront through development and effective governance.

On a global scale, the population of older adults, defined as individuals aged 60 and above, is rising in nearly every nation, a trend that is anticipated to continue. In 2023, there were 1.1 billion older adults population worldwide, constituting 13% of the global population. By 2030, this number is expected to surpass 1.4 billion, with a considerable proportion living in low-income countries[1]. In India, the elderly population was 10.1% in 2021 and is projected to reach 13.1% by 2031. This figure is expected to exceed 300 million by 2050, representing 20% of the total population[2,3].

Elderly individuals are particularly vulnerable to malnutrition, facing numerous challenges in meeting their nutritional needs[4]. Their dietary requirements can be ambiguous, as aging often results in decreased lean body mass and basal metabolic rate, which diminishes energy needs per kilogram of body weight. While some nutrient needs may decline, others may increase with age, underscoring the necessity to re-evaluate current daily nutrient guidelines for this demographic[5]. Older adults are at heightened risk of malnutrition due to various factors, including diminished appetite, inadequate intake of vital nutrients, impaired nutrient absorption and metabolism, functional disabilities, polypharmacy, and chronic health conditions associated with age-related physiological and psychological changes[6,7]. The aging process contributes to a decline in organ function, increasing susceptibility to chronic conditions such as Hypertension and Diabetes[8].

Editor's Comment :

- **Nutrition underpins healthy aging :** Poor nutritional status in community-dwelling older adults is closely linked to reduced functional capacity and a higher burden of chronic morbidities, highlighting nutrition as a core determinant of geriatric health.
- **Function is the missing connector :** Functional capacity acts as a critical bridge between nutrition and morbidity—malnutrition accelerates functional decline, which in turn worsens disease outcomes and dependence.
- **Integrated community action is essential :** Routine nutritional screening, functional assessment, and morbidity management should be combined at the primary-care and community level to prevent disability and improve Quality of Life among the elderly in Eastern India.

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While healthcare improvements may extend life, challenges like poverty and insufficient elderly support jeopardize their health, particularly in India, where families often provide critical long-term care. This situation leads to underreported malnutrition, highlighting the need to explore its relationship with functional abilities and health outcomes among older adults in the community, as research in this area remains scarce.

Materials and Methods

A descriptive epidemiological study with a cross-sectional design was conducted in the Bankura district of West Bengal, located in the Eastern region of India. This district, positioned in the Southern part of West Bengal, comprises three subdivisions and 22 Community Development Blocks, with a portion falling under the jurisdiction of Jungal Mahal. Bankura is primarily a rural district, with 91.67% of its population residing in rural areas and it has a higher proportion of Scheduled Castes (32.7%) and Scheduled Tribes (10.3%) compared to the state average of West Bengal, according to the 2011 Census[9,10].

The research was carried out over a period of six months, from February, 2021 to August, 2021. The participants in the study were elderly individuals aged over 60 years who were permanent residents of the designated area. Individuals who were unwilling or unavailable to participate were excluded from the study. The sample size was determined using a single proportion formula appropriate for cross-sectional studies, taking into account various factors such as the desired confidence level, acceptable margin of error, relative precision (considering a finite population), the design effect of the sampling method, and the expected prevalence of malnutrition among the elderly. There was a community-based study reporting the prevalence of malnutrition among the elderly in Bankura. Therefore, that study conducted in Bankura among geriatric residents, published in 2020, and was referenced, which indicated that 81.09% of the elderly population experienced malnutrition or were at risk of it[11]. Consequently, the anticipated prevalence of malnutrition in the study population was set at 81.09%. With a confidence level of 95% and a relative precision of 10%, the sample size was calculated using the specified formula.

$n = Z2\ (1 - \alpha/2)\ P\ (1 - P)/ e2$ where:

- $Z\ (1 - \alpha/2) = 1.96$ (at 95% confidence interval)
- P = anticipated proportion of malnutrition (81.09%)
- e = relative precision (10% of 81.09)

Thus, the calculated sample size became $n = (1.96)^2 \times 0.8109 \times 0.1891 / (0.10 \times 0.8109)^2 = 90$.

Considering 10% non-responders, the sample size was 99. As cluster sampling was done, a design effect of 2 was taken. Thus, sample size came out to be 198.

Bankura was chosen through simple random sampling from all districts in West Bengal. The study subjects were selected using a cluster sampling technique, where each village in the Bankura district was treated as a 'cluster'. Initially, a comprehensive list of all villages was compiled, including their respective populations and cumulative totals based on the 2011 Census data. From this list, 30 clusters (villages) were identified according to the principles of cluster sampling. In the subsequent stage, an equal number of study subjects were selected from each chosen cluster, resulting in a cluster size of approximately 7 individuals (198/30). Within each identified cluster, a list of all geriatric residents was created with assistance from local authorities. Seven geriatric individuals were then randomly selected without replacement from this list in each cluster. Their addresses were previously obtained from local health workers and interviews were conducted at their homes at mutually agreed times. In cases where any of the selected seven individuals did not respond, additional participants were randomly chosen from the same sampling frame to ensure the cluster size remained at seven. Consequently, data was collected from a total of 210 study subjects.

Pre-designed pre-tested interview schedule consisting of- Background characteristics & Socio-demographic characteristics, MNA-SF tool, the Katz Index of Independence in Activities of Daily Living (Katz ADL), the Cumulative Illness Rating Scale-Geriatric (CIRS-G) and any relevant medical records/prescription.

MNA-SF tool is a simple validated screening tool to assess the extent of malnutrition in community settings with specificity (100 %), sensitivity (97.9 %) and diagnostic accuracy (98.7 %) for the diagnosis of malnutrition, mainly in older adults. The internal consistency of the scale is good (Cronbach's α =0.843)[12,13]. It has 6 questions with anthropometric measurements like BMI or calf circumference and questions on loss of appetite, weight loss over past 3 months, mobility, acute illnesses, neuro-psychological morbidities etc. BMI was calculated by dividing weight (kg) by the square of the participants' height (m^2). Weight was calculated by digital weighing scale and height by non-stretchable elastic measuring tape.

Katz index of activities of daily living in assessing functional status of older people has an internal consistency measured with Cronbach's alpha of 0.82 and test-retest reliability evaluated with intra-class correlation (ICC) (95% CI) of 0.94 (0.89-0.96) ($p<0.001$) from a study published in 2023 in Sri Lanka[14].

The CIRS-G evaluates 14 organ systems, scoring from 0 to 56, using a 5-point scale. A score of 0 indicates no issues, while a score of 4 signifies extremely severe problems within that system. Participants who scored 0 were deemed to have no issues, whereas those with scores ranging from 1 to 4 were identified as having illness or impairment in that specific system. The overall CIRS-

G score was divided into tertiles. This scale demonstrates a moderate Cronbach's alpha of 0.55 for comorbidity, attributed to the independent nature of the component items that represent various organ systems. Cumulative Illness Rating Scale-Geriatric (CIRS-G) showed good divergent validity *vis-a-vis* functional disability in predicting mortality and hospitalization[15].

Interviewing of the study subjects, clinical and anthropometric examinations and reviewing of records like prescriptions, laboratory reports, social security cards were done for the study purpose.

The operational definitions utilized in the index study are as follows:

- Elderly refers to individuals aged 60 years or older[16].
- Literate denotes the ability to read and write meaningfully in any language.
- Earning is defined as the means of livelihood, excluding any social assistance.
- Socio-economic status is assessed using the modified B.G. Prasad scale (as revised according to AICPI January 2021), categorizing individuals into Upper (Class I & II) and Lower (Class III, IV & V) classes[17].

The research was conducted following the approval of the Institutional Ethics Committee at Bankura Sammilani Medical College, with permission granted by the Chief Medical Officer of Health in Bankura district. Informed consent was secured from all participants involved in the study. Eligible elderly individuals were interviewed using a pre-designed and pre-tested questionnaire, which was tailored for the study with input from public health experts. Data collection was carried out by the researchers after the questionnaire underwent translation, back-translation, and re-translation with the assistance of language specialists, followed by pre-testing among a convenience sample of 30 individuals visiting the outpatient department of Bankura Sammilani Medical College & Hospital. The individuals who participated in the pre-testing were excluded from the final study sample.

Utilizing the MNA-SF tool scores, the prevalence of malnutrition and the risk of malnutrition were assessed. This assessment categorizes individuals into three groups: normal nutrition (12-14 points), at risk of malnutrition (8-11 points), and malnourished (0-7 points). Individuals identified as at risk of malnutrition may exhibit diminished reserves and heightened risk factors, potentially leading to a transition towards malnourishment. Consequently, we have combined the two categories—those at risk of malnourishment and those classified as malnourished—into a single group for comparative analysis against individuals with normal nutritional status, aiming to elucidate the predictors of malnutrition among the elderly[12,13].

The Katz Activities of Daily Living (ADL) assessment measures six essential functions: bathing, dressing, toileting, transferring, continence, and feeding. Each function is assigned a score of 0 for independence or 1 for dependence, resulting in a total score that ranges from 0, indicating complete independence, to 6, indicating complete dependence[14].

The Cumulative Illness Rating Scale for Geriatrics (CIRS-G) evaluates 14 organ systems on a scale from 0 to 56, utilizing a 5-point scale where a score of 0 signifies no issues and a score of 4 indicates extremely severe problems within that system. Participants receiving a score of 0 are considered to have no issues, while those with scores ranging from 1 to 4 are identified as experiencing illness or impairment in the respective organ system[15].

Data were collected according to a predetermined and validated schedule, ensuring strict confidentiality. The information was input into Microsoft Excel, and all analyses were conducted using IBM's Statistical Package for the Social Sciences (SPSS), Version 20.0[18]. Descriptive statistics were employed to summarize demographic and anthropometric variables, reporting percentages and frequencies for categorical variables, while means and Standard Deviations were provided for continuous variables. The Chi-Square test assessed the association among the MNA-SF, ADL and CIRS-G categories. An independent t-test was utilized to evaluate the differences in MNA-SF scores between dependent and independent participants. One-way ANOVA was applied to compare the means of anthropometric and CIRS-G scores across MNA-SF categories. A significance level of p values ≤ 0.05 was established for all statistical tests.

Results

A total of 210 elderly study subjects were enrolled for the index study. The prevalence of malnutrition in this community based epidemiological study was 18.6% and at risk of malnutrition was 50%.

Socio-demographic characteristics of the study subjects: There were a slight female (55.2%) predominance among our study subjects. Early older adults (60-74 years) and middle older adults (75-84 years) were almost similar in prevalence among our study subjects at 42.8% and 40% respectively. About three-fourth of the study subjects belonged to the lower socio-economic class (74.8%). There was a significant association between age and nutritional status and socio-economic class ($p < 0.001$), in contrast, gender did not show any significant association with nutritional status. Another noteworthy finding was, there was a progressive decline of proportions of well-nourished elderly individuals with advancement of age (Table1).

Anthropometric details of the study subjects: The mean weight of the participants was 68.1 ± 7.8 kg. BMI was significantly associated with nutritional status ($p < 0.001$).

Among the malnourished participants, 68.7% had BMI<19 kg/m^2 while about half (49.4%) of well-nourished participants had a BMI≥23 kg/m^2 (Table 1).

Association of nutritional status with functional capacity: Table 2 displays the association of MNA-SF indicators of nutritional status with Katz ADL categories. About one-third of the participants were totally dependent (28.1%). There was progressive increment of proportions of dependent study subjects across the spectrum of malnutrition with 66.7%, 20.9% and 16.7% of them being malnourished, at risk of malnutrition and well-nourished respectively as per MNS-SF categories. There was a significant association between MNA-SF Indicators of Nutritional Status and Katz ADL Categories (p-value<0.001).

Association of nutritional status with indicators of morbidity: The association of CIRS-G indicators of morbidity with MNA-SF categories is outlined in Table 3. Malnourished participants had a significantly higher mean CIRS-G score (11.4 ± 5.1) than those at risk of malnutrition (9.4 ± 3.9) and well nourished (5.2 ± 2.7) (p<0.001). Nearly half of the malnourished participants (46.5%) belonged to the highest tertile for CIRS-G score while about one-tenth of the well-nourished study subjects (11.6%) were in the highest tertile for CIRS-G score. There was significant association between CIRS-G Indicators of Morbidity with MNA-SF Indicators of Nutritional Status.

Table 2 — *Association of MNA-SF Indicators of Nutritional Status with Katz ADL Categories*

Variable	Total (n=210)	Dependent (n = 59)	Independent (n = 151)	p-value
MNA-SF category, n(%)				0.001*
Malnourished	39 (18.6)	26 (66.67%)	13 (33.33%)	
Risk of malnutrition	105 (50.0)	22 (20.95%)	83 (79.05%)	
Well nourished	66 (31.4)	11 (16.67%)	55 (83.33%)	

**denotes statistical significance*

Table 3 — *Association of CIRS-G Indicators of Morbidity with MNA-SF Categories*

Variable	Total (n = 210)	Malnourished (n = 39)	At risk of malnutrition (n = 105)	Well nourished (n = 66)	p-value
CIRS-G score, n (%)					0.0000000397*
T1 (0–4)	73 (34.8)	13 (17.81%)	28 (38.36%)	32 (43.84%)	
T2 (5–13)	94 (44.8)	6 (6.38%)	59 (62.77%)	29 (30.85%)	
T3 (>13)	43 (20.4)	20 (46.51%)	18 (41.86%)	5 (11.63%)	

**denotes statistical significance*

Discussion

In the index study, the prevalence of malnutrition in this community based epidemiological study was 18.6% and at risk of malnutrition was 50% ie, about one-fifth and half of the study subjects respectively. This prevalence corresponds with the national estimate (18.3 %) but almost half (18.6% *versus* 32.2%) from another study in the same district of Eastern India. about half (49.4%) of well-nourished participants had a BMI ≥23 kg/m^2, suggesting that BMI is not a sensitive indicator of malnutrition in the elderly as obesity may be due to an underlying co-morbidity may mask the effects of malnutrition, frailty, and sarcopenia[19-20].

A significant association between MNA-SF Indicators of Nutritional Status and Katz ADL Categories was found in the index study which is in accordance with other studies both in India and abroad[21-24]. The reason for such association may be many-fold but many researchers suggests, that malnutrition may be responsible for muscle atrophy, osteopenia and sarcopenia which in turn may lead to decreased functional mobility and warrants functional disabilities in the elderly populations.

Nearly half of the malnourished participants (46.5%) belonged to the highest tertile for CIRS-G score while about one-tenth of the well-nourished study subjects (11.6%) were in the highest tertile for CIRS-G score. There was significant association between CIRS-G Indicators of Morbidity with MNA-SF Indicators of Nutritional Status which is in accordance with other studies, although the organ system considered in different studies are different but in the index study, morbidities of all organ systems were considered[25,26]. In this regard, it is pertinent to point that loss of vision, hearing impairment, dysphagia, multi-morbidities may all contribute to decreased appetite and reduced food-intake in the elderly contributing to malnourishment in them. The consumption of quality

Table1 — *Demographic and Anthropometric Characteristics by MNA-SF Categories*

Variable	Total (n = 210)	Malnourished (n = 39)	At Risk (n = 105)	Well Nourished (n = 66)	p-value
Gender, n (%)					0.873
Male	94 (44.8%)	16 (17.0%)	48 (51.1%)	30 (31.9%)	
Female	116 (55.2%)	23 (19.8%)	57 (49.1%)	36 (31.0%)	
Age group, n (%)					0.0000375*
Early older adults (60–74 years)	78(42.8%)	15 (19.2%)	17 (21.8%)	46 (59.0%)	
Middle older adults (75-84 years)	96 (40.0%)	19 (19.8%)	40 (41.7%)	37 (38.5%)	
Late older adults (85+ years)	36 (17.2%)	17 (47.2%)	13 (36.1%)	6 (16.7%)	
Socio-economic level, n (%)					0.001*
Upper	53 (25.2%)	0 (0.0%)	19 (35.8%)	34 (64.2%)	
Lower	157 (74.8%)	39 (24.8%)	86 (54.8%)	32 (20.4%)	
BMI category, n (%)					0.001*
<19 kg/m²	32 (15.2%)	22 (68.75%)	7 (21.88%)	3 (9.38%)	
19 to <21 kg/m²	56 (26.7%)	11 (19.64%)	37 (66.07%)	8 (14.29%)	
21 to <23 kg/m²	29 (13.9%)	3 (10.34%)	17 (58.62%)	9 (31.03%)	
≥23 kg/m²	93 (44.2%)	3 (3.23%)	44 (47.31%)	46 (49.46%)	

**denotes statistical significance*

nutrient–dense food, may further be deterred by certain socio-economic correlates like the increased price of foods, limited spending capacity of the elderly dependent population and out of pocket expenditure on health[11].

Conclusion

In this study, the majority of the elderly were at risk of malnutrition or were malnourished. Indicators of nutritional status were significantly associated with indicators of morbidity profile and categories of functional dependence. Considering the present trend of ageing population and the potential health challenges that may arise thereby, it is advisable to establish routine screening programs in community settings. These programs should assess the elderly for malnutrition risk in a timely manner. By identifying malnutrition risk early, healthcare providers can implement appropriate nutrition interventions. These may include dietary modifications, the provision of supplements, preventing catastrophic health expenditure and promoting food security in the otherwise financially dependent elderly population. Such actions will help ensure adequate nutrient intake, which is essential for maintaining health and improving quality of life. Addressing the unique needs of the elderly through proactive measures allows for the necessary support and care to maintain their health and well-being. However, due to the cross-sectional research survey design employed in this study, we were unable to establish a causal relationship between nutritional status, functional capacity, and morbidity profile. Future research aim a multi-centric study with a larger sample size, a more diverse population, and a longitudinal research design may overcome these limitations.

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