Assessing Nutritional Status and Functionality in Geriatric Population of Bangladesh: The Hidden Epidemic of Geriatric Malnutrition

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Abstract

The average life expectancy of the Bangladeshi population has risen over the last decade due to economic growth and improved medical care. Although the increased number of older adults and their health is a significant concern, there is scarce of data regarding that. A community-based cross-sectional study was conducted to analyze the association between nutritional status and functional ability among selected Bangladeshi geriatric populations living in their homes. Of 400 participants, the prevalence of malnutrition, and people at risk of malnutrition was 25.4% and 58.8%, respectively. Furthermore, almost 80% of participants are dependent in terms of activities of daily living. High risk of falling ($OR = 10.82$; 95% CI: 5.85–20.37; $p \leq .001$), limited activities of daily living (IADL) ($OR = 6.21$; 95% CI: 4.02–9.58; $p \leq .001$), along with dependency in performing IADL ($OR = 4.48$; 95% CI: 2.83–7.06; $p \leq .001$) are significantly associated with malnutrition. Geriatric malnutrition can accelerate disability conditions, leading to early functional aging.

Keywords

Introduction

The current global population of people aged 65 and more is estimated at 380 billion; this number is projected to more than double to almost 2 billion by the year 2050 (Nations, U, 2017). Although the proportion of older individuals is more significant in more developed nations, the senior population is growing faster in developing nations (Morley & Thomas, 2007). The geriatric population of Bangladesh is projected to reach 16.2 million by 2025 and 42.2 million by 2050, representing slightly more than 9% and 20% of the overall, respectively (Haque et al., 2014).

With the increase in the number of the aging population, an urgent question arises: Are we ensuring proper health for this growing segment of the population? The significant challenges of senior care in Bangladesh include the absence of any social security system, lack of employment opportunities, financial support, and inadequate social support programs (Ferdousi, 2020). As malnutrition is frequent in this age group, it is necessary to apply geriatric nutrition in order to manage physical, psychological, and psychosocial aspects as well as reduce the incidence of diseases among older adults

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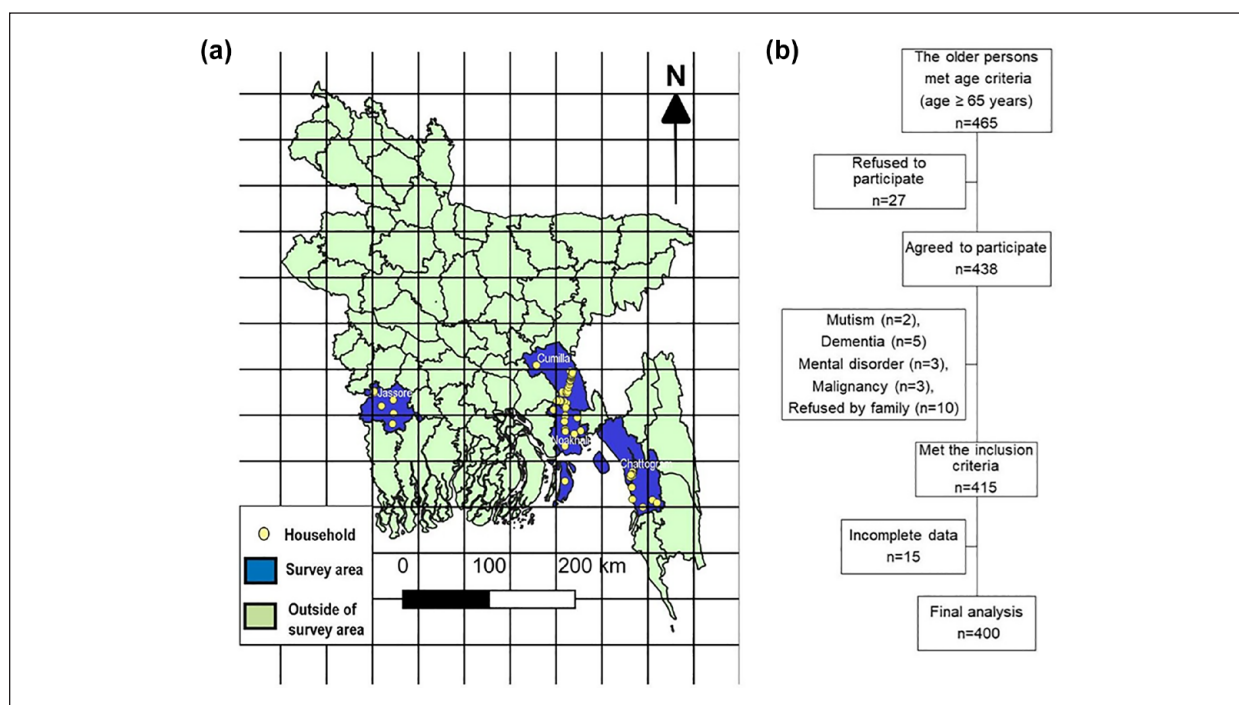Email: rahanur.ftns@nstu.edu.bd

Figure 1. (a) Survey area; blue color indicates the survey area and yellow circles represent selected households. The map was created by QGIS software (version 3.4.11). (b) The schematic diagram of study population selection.

(Razon et al., 2022). Both male and female geriatric populations are equally vulnerable, albeit older female groupings are more malnourished than male counterpart (Kabir, 2001; Razon et al., 2022).

The functional capability of the geriatric population is associated with nutritional status as malnutrition hinders the capability of daily activities of living (Urquiza et al., 2020; Wojzischke et al., 2020) and it constitutes a severe health problem. It is estimated that in 1 year, every third person over 65 years and every second over 85 years is subjected to falling (Borowicz et al., 2016). Previous studies have shown that geriatric functional disability reduces the quality of life of the senior population, and maintaining such functional capability is a challenging thing (Bai et al., 2020; Imamura et al., 2016). The prevalence of functional impairment in Asian elders ranged from 16.2% in China to 55.7% in India (Lestari et al., 2019). The significant causes of functional disability of the senior population are age (Ran et al., 2017), depression (Imai et al., 2015), frailty (Teo et al., 2017), underweight or obesity, body composition, physical inactivity, less engagement in the family or social work, and health complications (Wojzischke et al., 2020). Geriatric depression is a common mental disorder among older adults associated with malnutrition (Alam et al., 2021), which also increase the risk of developing ADL disability and mortality (Su et al., 2016). Lack of health care, poverty, health illiteracy, and the number of accessible geriatricians contribute to the undetected and untreated cases of malnutrition and functional disability among the aged population in Bangladesh (Abdullah et al., 2018; M. M. Rahman et al., 2021). Only a few studies were conducted in Bangladesh reporting the importance of senior health services and

programs (Abdullah et al., 2018; Hamiduzzaman et al., 2018; Tareque et al., 2017). In Bangladesh, among older people (7.5% of the total population), almost 62% are at risk of malnutrition (Ferdous et al., 2009; National Institute of Population Research and Training [NIPORT], 2013). However, there is a limited number of research assessing the impact of malnutrition on the functional abilities of the older population in Bangladesh as studies in Bangladesh are more focused on child and maternal health and nutrition (Kabir et al., 2006). Moreover, this population is more vulnerable and at risk of malnutrition and decreased functional ability.

This study aimed to determine the prevalence of functional dependency and malnutrition as well as the association between functional disability with nutritional status and other associated factors.

Methods

Study Design and Participants

It was a community-based cross-sectional study. The sample size was calculated by Epi Info software (version 7.2.3). The minimum sample size at a 95% confidence level was 348. Adding 10% non-response rate, the sample size was about 383. However, we collected 400 samples from four districts using multistage sampling. At first stage, four districts—Chattogram, Comilla, Jashore, and Noakhali—were selected by convenience sampling (Figure 1a). At second stage, we select at least five upazilas from the areas conveniently and then finally participants were chosen using random sampling from the areas.

Eligibility criteria. People who voluntarily agreed to participate in this study and were at least 65 years old were

included. Respondents who were mentally incompetent or unable to complete the evaluation or who refused to give consent were excluded from the study (Figure 1b).

Questionnaire and Data Collection Method

Participants were interviewed face to face using a pre-tested, validated questionnaire in the local language (English version of the questionnaire is provided in Supplemental Data) using android-based KoBoCollect (version 1.23.3) software. Data were recorded in that software by interviewees (under graduate students who were trained before collecting data). Self-reported Tinetti Performance Oriented Mobility Assessment (POMA) was used to measure the gait and balance ability as well as mobility. The POMA scale includes a balance scale and gait scale for balance maneuvers like sitting, standing up, standing with eyes closed, and turning 360°. Physical examination data were collected by involving the participants in respected activities. Participants were assigned into three different categories according to the total score as "high fall risk" ($\leq$19 points), "medium fall risk" (20–24 points), or "minimal fall risk" (25–28 points) (Tinetti, 2003). Activities of daily living (ADL) were evaluated using the Katz' index. In the questionnaire, there were six questions on vital activities of daily life (i.e., bathing, dressing, toileting, transferring, continence, and feeding). A total score of six was defined as "good," and a score of 0 to 5 was described as "poor" (Katz et al., 1963). The Lawton-Brody instrumental activities of daily living (IADL) scale assessed eight occupational performance areas: telephone use, shopping, food preparation, housekeeping, laundry, mode of transportation, medication management, and finances. A score of eight indicated independence, while a score of 0 to 7 indicated dependence on others (Lawton & Brody, 1969). The Mini Nutritional Assessment (MNA) was used to assess geriatric nutritional status (Cronbach's $\alpha = .73$). On a scale from 0 to 30, where 24 was considered optimal, 19 to 23 was considered at risk for malnutrition, and 18, or lower was considered malnourished (Vellas et al., 1999).

Internal consistency. The questionnaire's internal consistency was measured by Cronbach's α. Cronbach α was .825 for ADL, .713 for IADL, .940 for POMA, and .73 for MNA. The questionnaire's internal reliability was .935, ideal for field assessment.

Ethical consideration. The ethical approval for the current study was taken from Ethical committee of Noakhali Science and Technology University. The pros and cons of the study was discussed with the participants before collecting data.

Statistical Analysis

The Categorical variables are presented as frequency and percentages, whereas continuous variables are presented as mean and standard deviation. The correlation between categorical variables like age, gender, and nutritional status was determined using a Chi-square test. One-way ANOVA was performed on continuous variables like POMA score, Lawton-Brody IADL score, and Katz' index for the three nutritional status groups. Multinomial regression analysis was used to determine the association between nutritional status and functionality. Statistical significance was set at .05. Data analysis was conducted using Statistical Package for Social Sciences (SPSS) Version 23.0.

Results

The mean age of the study population is 72.1 ± 7.0 years. Three-quarters of the participants were considered "young old" (aged 65–74), 22% were "old" (aged 76–90), and the remaining 5% were "very old" (over 91 years old). According to the MNA score, a quarter of the sample population is malnourished, and more than half of the participants are at risk of malnutrition. Gait and balance tests indicate that more than 60% of the participants are at risk of high falling, and the percentage of medium and minimal fall risk is about 20.3% and 16.4%, respectively. According to the Katz' index of Independence in Activities of Daily Living (ADL), 38.3% of participants are dependent on doing daily activities. Assessment of independent living skills by The Lawton-Brody Instrumental Activities of Daily Living (IADL) Scale classifies almost 80% of the participants as dependent (Table 1).

The correlation among MNA, POMA, Katz' ADL, and Lawton-Brody IADL with the gender and age category of the respondents has been presented in Table 2. There was a statistically significant relationship between respondents' nutritional status and their scores on the Lawton-Brody IADL scale, accounting for age and gender. The correlation between the Katz' ADL index and age category was also statistically significant. However, no gender-specific correlation was found between the POMA score and the Katz' ADL.

Malnourished people had lower POMA, Katz' ADL and Lawton-Brody IADL scores compared to its healthy counterpart (Figure 2). All the scores are significantly lower in the malnourished group and at-risk group compared to the normal group (Table 3).

The POMA score has been proportionally increased with nutritional status (MNA) score, which means that those who have a higher score of MNA score (normal nutritional status) will have a better score of Tinetti Performance Oriented Mobility Assessment [POMA] (minimal fall risk). Both Katz's ADL and Lawton-Brody IADL score significantly correlate with the MNA score (Figure 2).

The association of POMA, Katz' ADL, and Lawton-Brody IADL with the Nutritional Status of the respondents has been presented in Table 4. The correlations among POMA, Katz' ADL, and Lawton-Brody IADL with the Nutritional Status of the respondents show statistically significant associations (Figure 3). A high risk

Table 1. Sociodemographic Characteristics, Nutritional Status, and Functionality of the Study Population.

Variable	Category	Frequency	Percentage
Age	Young old	304	76.0
	Old	87	21.7
	Very old	9	2.3
Gender	Female	200	50.0
	Male	200	50.0
MNA classification	Malnourished	102	25.4
	At-risk	235	58.8
	Normal	63	15.8
POMA classification	Minimal fall risk	66	16.5
	Medium fall risk	81	20.2
	High fall risk	253	63.3
Katz' ADL classification	Good	247	61.7
	Poor	153	38.3
Lawton-Brody IADL classification	Independent	81	20.3
	Dependent	319	79.7

Note. MNA = mini nutritional assessment; POMA = performance oriented mobility assessment; ADL = independence in activities of daily living; IADL = instrumental activities of daily living.

Table 2. Correlation of Nutritional Status, POMA, Katz' ADL, and Lawton-Brody Category With Gender and Age Category of the Respondents.

Characteristics	Gender			Age category			
	Female (%)	Male (%)	χ^2	Young old (%)	Old (%)	Very old (%)	χ^2
MNA classification							
Normal	41 (20.5)	22 (11.0)	7.35*	46 (73.0)	16 (25.4)	1 (1.6)	2.25
At risk	114 (57.0)	121 (60.5)		177 (75.3)	51 (21.7)	7 (3.0)	
Malnourished	45 (22.5)	57 (28.5)		81 (79.4)	20 (19.6)	1 (1)	
POMA classification							
High fall risk	137 (54.2)	116 (45.8)	4.98	190 (75.5)	56 (22.1)	7 (2.8)	.95
Medium fall risk	34 (42.0)	47 (58.0)		63 (77.8)	17 (21)	1 (2.8)	
Minimal fall risk	29 (43.9)	37 (56.1)		51 (77.3)	14 (21.2)	1 (1.5)	
Katz' ADL classification							
Good	116 (58)	131 (65.5)	2.38	175 (70.9)	64 (25.9)	8 (3.2)	10.2**
Poor	84 (42)	69 (34.5)		129 (84.3)	23 (15)	1 (0.7)	
Lawton-Brody IADL classification							
Dependent	198 (98.5)	121 (61.0)	87.08***	235 (73.7)	78 (24.5)	6 (1.9)	7.37*
Independent	3 (1.5)	78 (39.0)		69 (85.2)	9 (11.1)	3 (3.7)	

*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

for falls has been found to be significantly associated with nutritional status. Fall risk is significantly increased among adults who are malnourished or at risk of malnutrition compared to adults with normal nutritional status. Malnourished people are also more likely to depend on others for lifestyle activities and more complex community activities (Table 4).

Discussion

This study focuses on the relationship between nutritional status and functional health of the community-living geriatric population in Bangladesh. The result demonstrates that more than 84% were either malnourished or at risk of malnutrition, which corresponds with a previous study conducted in Bangladesh (K. M. T. Rahman et al., 2021; Razon et al., 2022). As there is no available gold standard technique of geriatric nutritional assessment (Abd Aziz et al., 2017), Mini nutritional assessment (MNA) was used to assess the nutritional status of the study population. MNA is better than simple anthropometry at estimating the nutritional status of community-living older adults (Hailemariam et al., 2016; Hudgens & Langkamp-Henken, 2004).

Table 3. Subject Characteristics According to Nutritional Status.

	Normal	At-risk	Malnourished	Total	
	n = 63	*n* = 235	*n* = 102	*n* = 400	
Variable	Mean ± *SD*	Mean ± *SD*	Mean ± *SD*	Mean ± *SD*	*F* statistic
POMA score	21.8 ± 4.6	16.4 ± 5.8	8.4 ± 6.3	15.2 ± 7.3	122.47*[a]
Katz' ADL score	6.0 ± 0.1	5.5 ± 0.8	3.9 ± 2.1	5.2 ± 1.5	85.46a*
Lawton-Brody IADL score	4.6 ± 1.8	3.9 ± 1.8	1.8. ± 1.9	3.5 ± 2.1	60.51*

[a]Asymptotically *F* distributed; therefore, robust tests of equality of means were performed.
*$p \leq .001$.

Table 4. Correlation and Regression Analysis of POMA, Katz', and Lawton-Brody Category With the Nutritional Status of the Respondents.

	MNA classification				
Characteristics	Normal (%)	At-risk (%)	Malnourished (%)	χ^2	OR (95% CI)
POMA classification					
High fall risk	11 (4.3)	147 (58.1)	95 (37.6)	99.01*	10.82* (5.85–20.37)
Medium fall risk	25 (30.9)	50 (61.7)	6 (7.4)		1.68 (0.93–3.04)
Minimal fall risk	27 (40.9)	38 (57.6)	1 (1.5)		1 (Ref)
Katz' ADL classification					
Good	62 (25.1)	155 (62.8)	30 (12.1)	82.78*	1 (Ref)
Poor	1 (0.7)	80 (52.2)	72 (47.1)		6.21* (4.02–9.58)
Lawton-Brody IADL classification					
Dependent	33 (10.3)	187 (58.6)	99 (31)	48.15*	4.48* (2.83–7.06)
Independent	30 (37)	48 (59.3)	3 (3.7)		1 (Ref)

Note. OR = odds ratio; CI = confidence interval.
*$p \leq .001$.
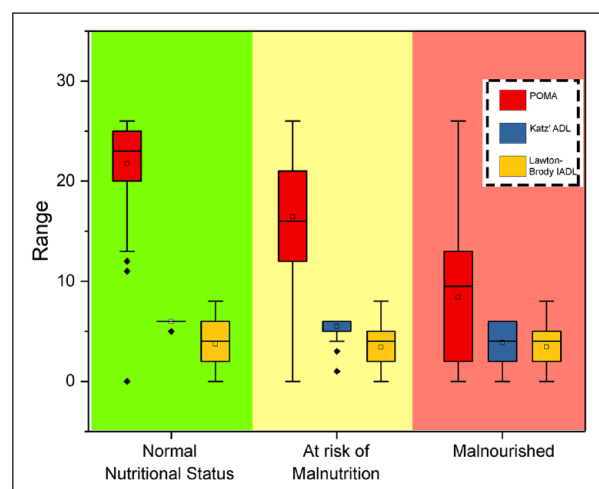
Figure 2. Graphs depicting the effects of malnutrition on the POMA score (Red box), Katz' ADL (blue box) and Lawton-Brody IADL (yellow box) scores.

In the present study, malnourished and people at risk of malnutrition have shown significantly lower POMA scores compared with nourished subjects. Therefore, people with high fall risk have a higher tendency of being malnourished (OR: 10.82, 95% CI: 5.85–20.37, $p \leq .001$), which is in line with the literature (Chu et al., 2015; Thomas & Lane, 2005). Malnutrition can lead to significant loss of muscle mass (Pierik et al., 2017), which is associated with impaired balance and a high risk of falling in older adults (Szulc et al., 2005). Loss of muscle mass and functional ability at older age are due to low energy intake than bodily requirement. Low energy intake (means lack of proper nutrient) also is also associated with decreased muscle strength, physical performance and disability (Volkert, 2013).

Malnutrition is associated with poor ADL (OR: 6.21, 95% CI: 4.02–9.58, $p \leq .001$), as well as dependence on help to perform IADL (OR: 4.48, 95% CI: 2.83–7.06, $p \leq .001$). It was found that women suffer more from osteoporosis and dementia than men, which are related to malnutrition (Gómez-Gómez & Zapico, 2019; Huffman et al., 2018). The risk of osteoporosis and dementia also increased with the lower score in ADL and IADL (Brodaty et al., 2016; Huffman et al., 2018). Consistent with our findings, some studies find significant differences in decreasing ADL, IADL, and nutritional status in women than men (Sawada et al., 2021). Adjusted regression analysis showed that functional
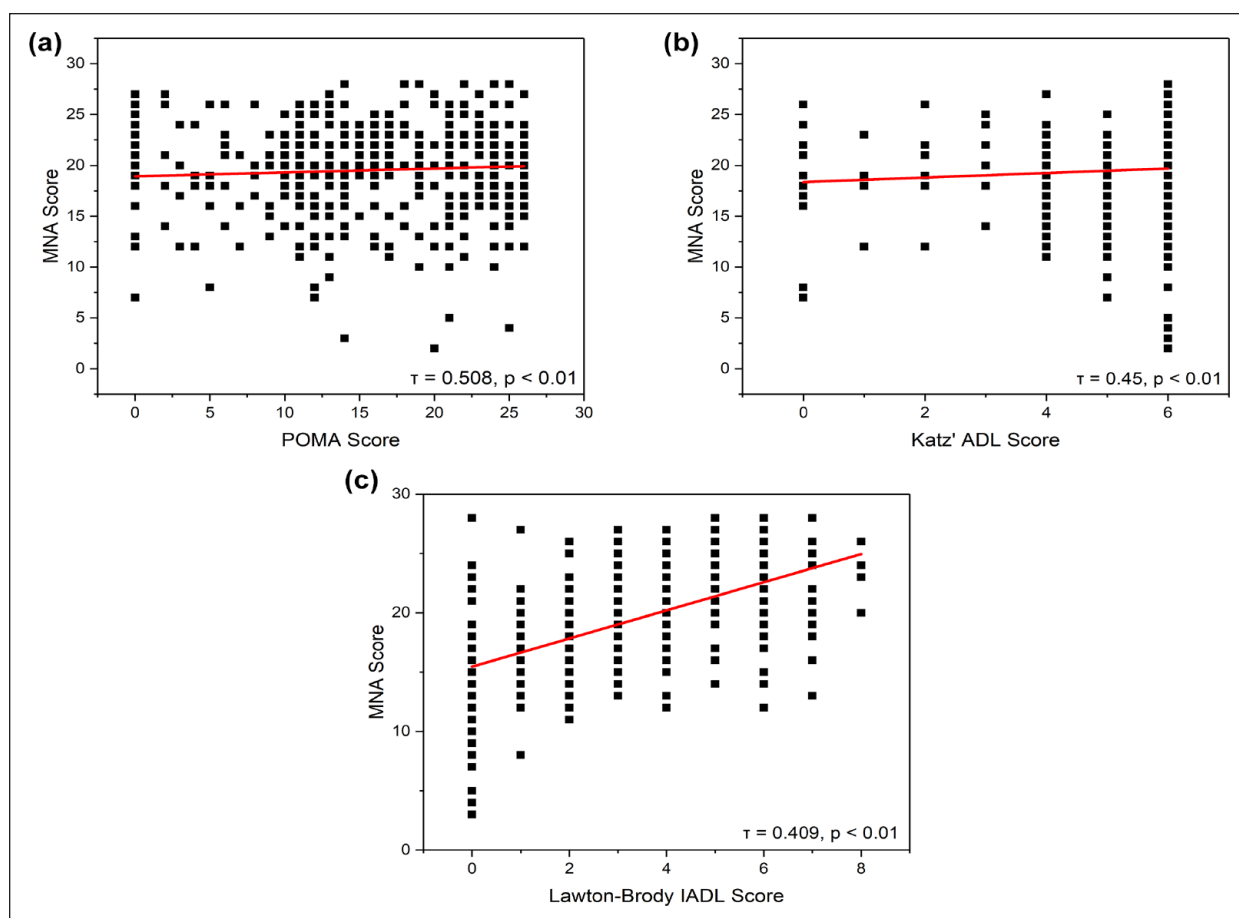
Figure 3. Relationship among MNA score and POMA score (a), Katz' ADL (b), and Lawton-Brody IADL score (c).

ability was associated with nutritional status according to MNA, which is consistent with many studies (van Bokhorst-de van der Schueren et al., 2013; Zhang et al., 2019). The result indicates that the consequences of malnutrition is more problematic among ADL and IADL dependence.

Some studies found that vision and cognition impairment was associated with ADL dependencies like dressing, bathing, eating, and toileting, and gender-wise analysis showed a significant correlation between functional disability and functional disability cognition (Cigolle et al., 2007; Pengpid & Peltzer, 2021).

The main strength of the present was the inclusion of home-living older population and assess the interaction between malnutrition and functional ability using different scales. This study had several limitations. Our study was a questionnaire-based, cross-sectional study. Therefore, the result can only provide a snapshot of the current nutritional status and functional health of the study population. Though poor functionality is associated with malnutrition, causation cannot be established due to the multifactorial nature of malnutrition. Secondly, MNA, Lawton IADL, and Katz' ADL scale are mainly based on self-reported information. Therefore, there is a possibility of overestimation or underestimation.

Conclusion

The prevalence of malnutrition among older people in Bangladesh is deplorable, and poor functional health has shown a significant association with geriatric malnutrition. Malnutrition can lead to functional disability in older adults by causing weakness, fatigue, and muscle loss. The evidence from the study indicates the importance of nutritional screening and associated risk factors of malnutrition combined functional ability. Enhancing the nutritional status of older adults can decrease their risk of functional disability, thus improving their quality of life and decrease the risk of mortality.

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