Original Article

Prevalence and determinants of geriatric malnutrition among rural populations: A Community based cross-sectional Study in Eastern India

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Abstract

Background: The World's population is aging due to simultaneous declining of birth as well as death rate leading to the phenomenon of demographic burden. The dependent population compounded by their chronic morbidities have little resources left to maintain a healthy nutrition, culminating in another morbidity i.e., geriatric malnutrition, which is grossly un-diagnosed and un-reported. A commitment to the Sustainable Development Goals means a commitment to Healthy Ageing, hence WHO had declared the next decade (2020-2030) as the "Decade on Healthy Ageing". Thereby, the present study aims to find the prevalence and correlates of elderly malnutrition in the index population.

Methodology: A cross-sectional study was conducted among 180 geriatric individuals of Bankura district of West Bengal using 30 cluster sampling design. Data on nutritional status were collected using MNA-SF questionnaire and correlates were assessed by a pre-designed pre-tested schedule Multivariable logistic regression was done to ascertain the factors influencing elderly malnutrition.

Results: Prevalence of geriatric malnutrition was 32.2% and risk of malnutrition was 48.89%. Presence of chronic diseases, poor socio-economic status, polypharmacy, food insecurity, catastrophic health expenditure and absence of social insurance were found to be significantly associated with geriatric malnutrition

Conclusion: Geriatric malnutrition was found to be considerably high in the study population. The complex interplay of multiple factors was found to culminate it, upon which socio-economic and health care affordability issues were prominent. A multi-disciplinary approach focusing on social security, improved health care delivery with Patient Oriented Evidence that Matters (POEM) approach may help in mitigating the issue.

Introduction

The era of advanced technology, educational opportunities, women empowerment and economic development resulted in demographic transition. There is simultaneous decline in both birth rate and

death rate, leading to rising dependency ratios. This is an inevitable consequence of demographic transition and every country has to face this problem with development and successful demographic transition (1).

Both the number and the proportion of older persons - defined as aged 60 and over in developing countries- are growing in virtually all countries, and worldwide trends are likely to continue unabated. In 2017 there were an estimated 962 million older persons in the world (comprising 13 per cent of the global population). By 2030, the number of older persons worldwide is expected to reach more than 1.4 billion, with a majority of them in low-income countries (2).

According to the 2011 census, India has 104 million elderly persons (defined as 60 years and above), constituting 8.6% of the total population. Amongst them, more than 30 million are living in urban areas. This number is expected to increase as the number of elderlies in the country will reach 173 million by 2026 and will be more than 300 million by 2050, accounting for 20% of the population (3).

Elderly persons are particularly vulnerable to malnutrition but attempts to provide them with adequate nutrition may encounter many practical problems. "First, their nutritional requirements are not well defined. Since both lean body mass and basal metabolic rate decline with age, an older person's energy requirement per kilogram of body weight is also reduced. The process of ageing also affects other nutrient needs. For example, while requirements for some nutrients may be reduced, some data suggest that requirements for other essential nutrients may in fact rise in later life." Thereby, is thus an urgent need to review current recommended daily nutrient allowances for this group (4).

A panorama of geriatric morbidities is a result of a complex interplay of different nutrition related factors operating since infancy. "These factors are then compounded by changes that naturally occur with the ageing process. As for example, dietary fat seems to be associated with diabetes, osteoporosis, atherosclerosis and various cancers. Increasingly in the diet/disease debate, the role that micronutrients play in promoting health and preventing non-communicable disease is receiving considerable attention. Micronutrient deficiencies are often common in elderly people due to a number of factors such as their reduced food intake and a lack of variety in the foods they eat." Compounding this situation is the fact that the increasing price of foods, their limited spending capacity and out of pocket expenditure for health-related issues further discourages their consumption.

There is dearth of published literature on elderly malnourishment in this part of the World. In this scenario, a study to find out the prevalence and risk factors of malnutrition in the elderly population of Bankura District was warranted. Thereby, the study was done to find out the prevalence and predictors of malnutrition among elderly population in Bankura district of West Bengal.

Methods

A community based descriptive epidemiological study with cross-sectional design was done in the Bankura district of West Bengal, situated in the Eastern part of India. Bankura district is situated in the southern part of West Bengal. This district has 3 subdivisions and 22 Community Development Blocks, out of which falls under the jurisdiction of Jungal Mahal. It's a predominantly rural district (91.67%) & Schedule caste (32.7%) and Schedule tribe (10.3%) of total population of Bankura is higher than the average the state of West Bengal (Census 2011).

The study was conducted for a duration of 3 months from March 2019 – May 2019.

Study subjects were geriatric (>60years) permanent resident of the study area. We excluded, Un-willing or un-available study subjects.

Sample size was estimated using single proportion formula for cross sectional studies considering the factors of: desired level of confidence, acceptable margin of error, relative precision (as finite population taken), design effect of the sampling technique, anticipated proportion of geriatric malnutrition. Community based studies showing proportion of geriatric malnutrition in Bankura were lacking. So, a study conducted in Burdwan among slum dwellers published in 2017 is considered here where 84.8% of elderly had malnutrition or were at risk of malnutrition (5). The anticipated proportion of malnutrition among the study population thus was taken as 84.8%. Considering 95% level of confidence and 10% relative precision, the sample size was calculated using the following formula:

$n = Z^2 (1 -\alpha/2) P (1 - P)/ e^2$ where:

• Z (1 -α/2) = 1.96 (at 95% confidence interval)

• P = anticipated proportion of malnutrition (84.8%)

• e = relative precision (10% of 84.8)

Thus, the calculated sample size became n = $(1.96)^2$ x 0.848 x 0.152 / $(0.10 X 0.848)^2$ = 72.

Considering 10% non-responders, the sample size was 80. As cluster sampling was done, a design effect of 2 was taken. Thus, sample size came out to be 160.

By simple random sampling Bankura was selected from the all the districts of West Bengal. Cluster sampling technique was applied to select the study subjects. Each village of Bankura district was considered as 'cluster'. In the first stage list of all villages was prepared with their respective population and cumulative population (based on Census data 2011) and 30 clusters (villages) was identified using principles of cluster sampling. In the second stage, from each selected cluster equal number of study subjects was included, thus cluster size was 160/30 ~6

In an identified cluster which is a village, list of all the geriatric inhabitants was prepared with the help of local authorities. 6 geriatric individuals were selected by simple random sampling (without replacement) from the prepared sampling frame from each cluster. Their addresses were obtained beforehand from local health workers and they were interviewed at their household at mutually convenient time. If there are non-responders from the selected 6 individual in each cluster, rest of the participants was selected again randomly from the previously prepared sampling frame in each village to complete the cluster size of 6. Thereby, we had collected data from 180 study subjects.

Pre-designed pre-tested interview schedule consisting of- Background characteristics & Socio-demographic characteristics, MNA-SF tool, any relevant medical records/prescription. MNA-SF tool is a simple validated screening tool to assess the extent of malnutrition in community settings with high sensitivity (98.9%) and specificity (94.3%). 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.

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 following operational definitions were used in the index study. Elderly: Individuals greater than or equal to 60 years of age. (4), Literate: To read and write meaningfully in any language, Earning: Earning a livelihood, any social assistance was not considered, Social support: Any family member or care-giver present or not and if present will they be available on need, Chronic disorders: Any documented hypertension, diabetes, cardiovascular, neurological, chronic obstructive pulmonary disease, musculo-skeletal disorders, urinary incontinence or urinary retention or recurrent gastro-intestinal ailments present alone or in combination for were considered as chronic disorders in the study, Orthopaedic disabilities: It was determined according to whether the participant was using a crutch, walker, wheelchair or any other support for walking in his household, Cognition: Assessed by 3 minute mini-cog test, this is a validated screening instrument, Socio-economic status: Modified B.G. Prasad scale (modified as per AICPI February 2019) was used. Upper (Class I & II of modified BG Prasad scale) and Lower (Class III, IV & V of modified BG Prasad scale) were the 2 classes considered in the study, Polypharmacy: It was defined quantitatively as five or more drugs are used concurrently, Food security: Food security was assessed as per the protocol described in the Nutrition Survey of the Elderly in New York State (NSENY):(6)

- ''Do you have enough money to buy the food you need most of the time?''
- ''In the past 6 months, have you skipped one or more meals because you had no food in the house or you thought that soon you might not have enough food?''
- ''In the past 6 months, have you had to choose between buying food or paying bills or buying something else you needed?''

If the answer was ''yes'' to at least one of these questions it was evaluated as 'food insecure'.

Household catastrophic health expenditure: It was defined as out-of-pocket expenditure on health greater than or equals to 40 % of the family's non-food expenditure, Social insurance: Any BPL card, old age pension scheme, subsidised food grains, pension, Swasthya sathi card, Ayushman Bharat card were considered for social assistance.

The study was conducted after the approval of the Institutional Ethics Committee Bankura Sammilani Medical College. Permission was obtained from the Chief Medical Officer of Health, Bankura district. Informed consent was obtained from all the study participants.

The eligible geriatric persons were interviewed using the pre-designed pretested schedule for after obtaining written informed consent. The schedule was customised for the study with the help of the subject experts of public health. Data were collected by the researchers after translation, back-translation, and re-translation of the prepared schedule was done with the help of language experts, followed by pre-testing among a convenience sample of 30 individuals attending the OPD of Bankura Sammilani Medical College& Hospital. The pre-tested subjects were not included as study subjects in the study.

Based on the scores in MNA-SF tool prevalence of malnutrition, at risk of malnutrition was calculated. It has 3 categories, normal nutrition (12-14 points), at risk of malnutrition (8-11 points) and malnourished (0-7 points). Those who are at risk of malnutrition may have reduced reserve and increased risk factors which may shift them in the spectrum of malnourishment soon. So, we have clubbed the 2 groups i.e. risk of malnourishment and malnourished as a single group and compared that with the individuals with

normal nutritional status to find out the relationship of the predictors of malnutrition in the elderly.

The exploratory variables were classified under three constructs of social factors, physical factors and economic factors.

Data were collected in predesigned and pretested schedule and handled with strict confidentiality. Data were entered into Excel (Microsoft Inc.) and all calculations were done using IBM Statistical Package for the Social Sciences (SPSS) (Version 20.0, IBM). Data were analysed and presented using principles of descriptive and analytical statistics. Categorized variables were presented as percentages and continuous variables in mean and standard deviation. The association between independent variables with malnutrition and risk of malnutrition (Univariate analyses) were ascertained by Chi-square test. $P < 0.05$ was considered as the significance level. Multivariate logistic regression was carried out with all the variables classified under three constructs of social factors, physical factors and economic factors to determine the affecting factors of geriatric malnutrition after adjusting for confounders. The adjusted odds ratios along with its 95% confidence interval were calculated. 95% confidence interval not including 1 was regarded as significant. Hosmer and Lemeshow test was performed to test the goodness of fit of each of the 3 models and Nagelkerke R^2 and Cox and Snell R^2 as well as classification

table of the models was also computed to analyse the variances of the predictors of geriatric malnutrition in the present study. Receiver operating characteristic curve of the three models were constructed to assess the diagnostic ability of the categorical variables. AUROC of 1 was considered ideal and 0.5 corresponds to flipping of a coin.

Results:

**Descriptive of the study subjects:**

The mean age of the study subjects were 72.1 years with a standard deviation of 7.84 years. Majority of the study subjects were males (52.2%), single/widowed (64.4%), illiterate (63.3%) and non-earning (56.1%). (Table 1)

Chronic diseases (72.2%) were present in majority of them. Hypertension (63.8%), diabetes (39.6%), COPD (18.7%), musculo-skeletal disorders (84.2%) were mostly prevalent in the study subjects as a single disease or in combinations of one or more chronic diseases.

69.4% belongs to lower socio-economic status (class 3-5 of modified BG Prasad scale February 2019), had food insecurity (67.2%), practicing polypharmacy (63.3%) and having catastrophic health expenditure (62.2%).

Prevalence of geriatric malnutrition was 32.2% and risk of malnutrition was 48.89% in the index study population. (Figure 1)

Figure1. Distribution of study subjects as per their nutritional status (N = 180)

- Normal
- Risk of malnutrition
- Malnourished
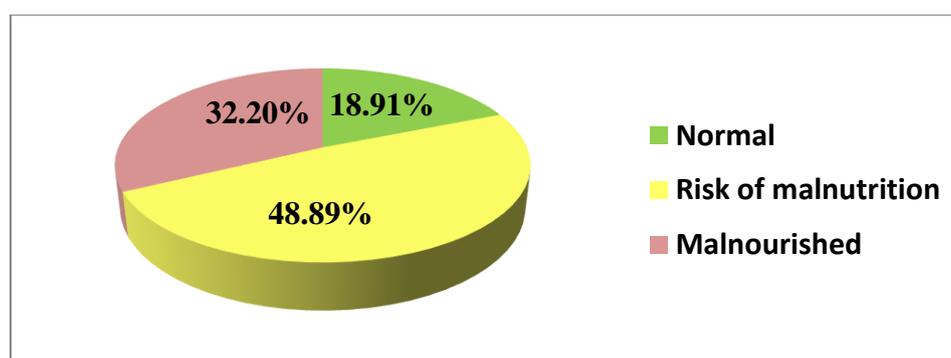
Table1. Distribution of malnutrition and risk of malnutrition among the study subjects (N = 180)

	Risk factors	Nutritional status			χ^2	df	P value
		Normal (N, %)	At risk of malnutrition (N, %)	Malnourished (N, %)			
Gender	Male	18(19.1)	46(48.9)	30(31.9)	0.13	2	0.994
	Female	16(18.6)	42(48.8)	28(32.6)			
Marital status	Married	18(28.1)	36(56.3)	10(15.6)	14.076	2	*0.001
	Single/widowed	16(13.8)	52(44.8)	48(41.4)			
Education	Illiterate	18(15.8)	58(50.9)	38(33.3)	1.952	2	0.377
	Literate	16(24.2)	30(45.5)	20(30.3)			
Occupation	Earning	20(25.3)	38(48.1)	21(26.6)	4.487	2	0.106
	Non-earning	14(13.9)	50(49.5)	37(36.6)			
Social support	Present	20(20)	52(52)	28(28)	1.837	2	0.399
	Absent	14(17.5)	36(45)	30(37.5)			
Chronic diseases	Present	14(10.8)	67(51.5)	49(37.7)	21.353	2	*0.000
	Absent	20(40)	21(42)	9(18)			
Orthopedic disabilities	Present	10(13.2)	34(44.7)	32(42.1)	6.738	2	*0.034
	Absent	24(23.1)	54(51.9)	26(25)			
Cognitive disorders	Present	11(19.3)	31(54.4)	15(26.3)	1.426	2	0.490
	Absent	23(18.7)	57(46.3)	43(35)			
Socio-economic status	Upper	18(32.7)	25(45.5)	12(21.8)	10.881	2	*0.004
	Lower	16(12.8)	63(50.4)	46(36.8)			
Poly-pharmacy	Present	10(8.8)	60(52.6)	44(38.6)	21.658	2	*0.000
	Absent	24(36.4)	28(42.4)	14(21.2)			
Food security	Present	24(40.7)	25(42.4)	10(16.9)	29.176	2	*0.000
	Absent	10(8.3)	63(52.1)	48(39.6)			
Household catastrophic health expenditure	Present	13(11.6)	57(50.9)	42(37.5)	11.129	2	*0.004
	Absent	21(30.9)	31(45.6)	16(23.5)			
Social insurance	Present	5(35.7)	6(42.9)	3(21.4)	2.937	2	0.230
	Absent	29(17.5)	82(49.4)	55(33.1)			

* denotes statistical significance

Table 2. Multivariate models of predictors of geriatric malnutrition among study subjects

	Predictors		Model 1	Model 2	Model 3
	Intercept		-4.469	-4.521	-8.275
Social factors	Age		*1.07(1.00-1.15)	1.05(0.98-1.13)	1.04(0.95-1.13)
	Gender	Male	1.03(0.47-2.28)	1.09(0.46-2.61)	0.80(0.28-2.31)
		Female ®	1	1	1
	Marital status	Married®	1	1	1
		Single/widowed	1.70(0.75-3.83)	1.30(0.54-3.17)	1.76(0.62-5.05)
	Education	Illiterate	1.74(0.77-3.96)	2.02(0.79-5.09)	2.05(0.66-6.34)
		Literate®	1	1	1
	Occupation	Earning®	1(ce)	1()	1(Re)
		Non-earning	1.68(0.72-3.90)	1.86(0.74-4.69)	1.12(0.36-3.45)
	Social support	Present®	1	1	1
		Absent	1.23(0.55-2.75	1.11(0.45-2.75)	1.25(0.40-3.90)
Physical factors	Chronic diseases	Present		*3.03(1.15-7.97)	*3.20(1.01-10.17)
		Absent®		1	1
	Orthopaedic disabilities	Present		1.49(0.59-3.82)	3.29(0.94-11.51)
		Absent®		1	1
	Cognitive disorders	Present		1.19(0.47-3.03)	1.65(0.50-5.48)
		Absent®		1	1
Economic factors	Socio-economic status	Upper®			1
		Lower			*5.50(1.84-16.49)
	Poly-pharmacy	Present			*4.76(1.47-15.44)
		Absent®			1
	Food security	Present®			1
		Absent			*6.98(2.27-21.47)
	Household catastrophic health expenditure	Present			*3.09(1.01-9.44)
		Absent®			1
	Social insurance	Present®			1
		Absent			*7.30(1.36-38.45)

* denotes statistical significance, ® - denotes reference

Table 3 Model statistics for the three predictive models

Model statistics	Omnibus Tests of Model Coefficient			Hosmer Lemeshow P	Log Likelihood	Cox & Snell R^2	Nagelkarke pseudo R^2	AUROC
	χ^2	df	Significance					
Model 1	14.92	6	0.02	0.962	159.543	0.080	0.128	0.717
Model 2	36.94	10	0.00	0.847	137.520	0.186	0.299	0.823
Model 3	73.14	14	0.00	0.738	101.322	0.334	0.538	0.915

Factors associated with geriatric malnutrition

Univariate analysis using chi-square test

The independent variables which were significantly affecting study subjects with malnutrition and at risk of malnutrition were being single/widowed, having chronic diseases and orthopaedic disabilities, belonging to lower socio-economic status, having food insecurity, practicing polypharmacy and experiencing catastrophic health expenditures. (Table 1)

Multivariate analysis

Table 2show three predictive models for predicting the geriatric malnutrition that were developed for the present study. Model 1 includes only the social factors; Model 2 includes the social and physical parameters related variable and Model 3 includes the economic related variables in addition to the variables in Model 2.

According to the final model i.e. Model 3 of the multivariate logistic regression analysis after controlling the variables which may be related both with the cause as well as the effects of the study i.e. the confounders, the following were found to be significantly increasing the risk of malnutrition in the geriatric populations i.e., having chronic diseases, belonging to lower socio-economic status, having food insecurity, practicing polypharmacy, experiencing catastrophic health expenditures and lack of social insurance.

The present study utilised Receiver Operating Characteristics curve (ROC) and Area Under Receiver Operating Characteristics curve (AUROC) to measure the quality of the classification models. It was seen that inclusion of physical factors improved the model i.e. AUROC 0.717 in Model 1 to AUROC 0.823 in Model 2. On addition of economic factors in Model 3 the AUROC improves further to 0.915. (Figure 2/Table3)
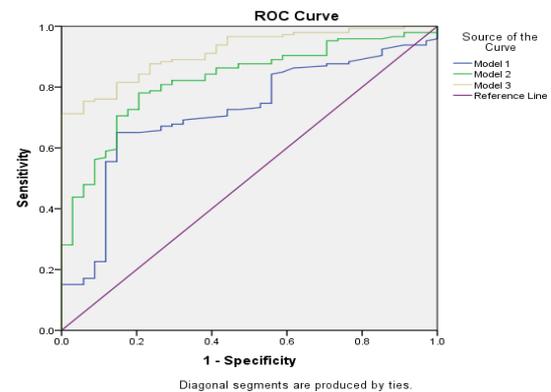

Figure 2. ROC curve showing the three predictive models

Discussion:

Prevalence of geriatric malnutrition using MNA-SF tool was 32.2% and risk of malnutrition was 48.89% in the index study population, which is in accordance with a community based study in Burdwan district, a clinic based study in rural areas of Hooghly district and studies from the neighboring countries, Bangladesh and Nepal (5-9). But in studies at other parts of India, like Coimbatore, Dehradun, etc. the

prevalence of geriatric malnutrition is less than the present study but the prevalence of risk of malnutrition is quite similar while a study in Ambala, Haryana shows increased prevalence (64%) of risk of malnutrition amidst a decreased prevalence of geriatric malnutrition (26%) (10-12).In studies from Japan, there was increased prevalence of risk of malnutrition (58%) amidst a decreased prevalence of geriatric malnutrition (19.9%) while studies in Lebanon (8% & 29.1%) and Turkey (2.7% & 28%) had a decreased prevalence of both malnourished and risk of malnourishment in study subjects than in our study (6,13,14).

Poor socio-economic conditions were found as a significant factor in our study as also in studies in India and abroad (7-12). The reason may be dietary choices and feeding frequency all depends upon the socio-economic status of the person. It also highlights the plight of the dependent segment of our population in terms of food security. In fact, lack of food security was found as a significant predictor of elderly malnutrition in our study as also in other studies in Turkey and Lisbon (6,15).

Chronic diseases were found as significant predictor for geriatric malnutrition in our study as also in other studies both in India and abroad (7,8). The reason may be due to the effect of the disease itself manifesting as poor appetite, decreased food absorption etc. or it may be due to other factors associated with chronic diseases like poly-pharmacy and catastrophic health expenditure. In the index study both poly-pharmacy and catastrophic health expenditure were found significantly associated with geriatric malnutrition.

Poly-pharmacy was found to be associated with geriatric malnutrition in other studies as well (16-18). The reason may be manifold like drug-drug interactions, drug-food interactions leading to poor appetite and decreased food absorptions, also, there may be issues like the dependent elderly

has hardly any resources left to buy food items after buying the medicines for various morbidities.

Catastrophic health expenditure was found as a predictor of geriatric malnutrition in both univariate and multivariate analysis in our study, the result of which is in accordance with other studies in Asia and Europe (19-20). The out-of-pocket expenditure on health may culminate in catastrophic health expenditures when there is complex interplay of the following factors, lack of availability of free or affordable health care services, inability of the vulnerable socio-economically dependent elderly population to pay for health care services and lack of universal health insurance coverage for the masses. In fact, social insurance was found to be a significant protective factor in geriatric malnutrition in our study.

The strength of our study includes the fact that it was a community-based study and the interview and the examinations were conducted by the trained researchers themselves. The limitation of the study was its cross-sectional design which limits the ability to predict temporal association. A follow up study is warranted in this regard. Recall bias was taken care of by validating the information from record reviewing of prescriptions, laboratory reports and social security cards.

Conclusion:

Geriatric malnutrition in the estuarine block of Bankura was found to be considerably high. The complex interplay of multiple factors was found to culminate it, upon which socio-economic and health care affordability issues were prominent. In the era of Evidence Based Medicine (EBM), we often ignore all the cumulative importance of 3Es of EBM, i.e. Scientific Evidence, Patients Expectations and Physician's Experience, that in turn, may make us prescribe the most efficacious drugs for the patient based on the latest

scientific evidences but may make a patient skip a meal to buy the medicines, which is unwarranted for any physician. Thereby, a paradigm shift of health care approach from Disease Oriented Evidence (DOE) to Patient Oriented Evidence that Matters (POEM) will help bridge the gap between healthcare accessibility and affordability. A multi-disciplinary approach focusing on poverty alleviation, social security, community-based health insurance, rational prescription practices, improved health care delivery, nutrition education and periodic screening of geriatric population may go a long way in improving the nutrition of the geriatric population.

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