

Nutritional Status Among Adult Muslims: A Study from Purba Medinipur, West Bengal, India

Dr. Argina Khatun¹

¹Assistant Professor, Department of anthropology, North Bengal University, Darjeeling, West Bengal, PIN- 734013.

ABSTRACT Malnutrition (Undernutrition as well as overnutrition) among rural population is a major health problem in India. A cross-sectional study was conducted to examine nutritional status (prevalence of undernutrition, overweight and/or obese) based on body mass index (BMI) and its association with some socioeconomic variables. Present study also investigated undernutrition based on MUAC values. A total of 645 Bengali speaking adult Muslims (Males: n=279 and Females: n=366) aged above 18 years were studied randomly from eight villages. Three anthropometric variables (height, weight and MUAC) have been used in the present report and body mass index was calculated for assessing nutritional status. Mean BMI value of both the sexes has significantly increased with their age advances. The prevalence of undernutrition of males and females were medium (16.1% and 15.9%), that suggests this situation is a 'poor situation'. Females have a higher prevalence of overweight and obesity than males. The prevalence of overweight of males and females were 14.3% and 27.6%. Coexistence of overnutrition and undernutrition (dual burden of malnutrition) were seen of the studied population. The association between undernutrition and overweight/obese with age groups, monthly per capita income groups, education were statistically significant. Health-related interventions are needed for improvement of their overall nutritional condition. Further research is also needed to identify other factor(s) associated with malnutrition among the specified population.

Keywords: Anthropometry, Body Mass Index, Nutritional status, Malnutrition, Muslim population, Rural adults, West Bengal, India

Address for correspondence: Dr. Argina Khatun, Assistant Professor, Department of anthropology, North Bengal University, Darjeeling, West Bengal, PIN - 734013. E-mail: arginakhatun87@gmail.com

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INTRODUCTION

The Global Nutrition Report 2018, which looked at 140 countries including India, found 'significant burdens' of three important forms of malnutrition used as an indicator of broader trends. These include childhood stunting, anaemia in women of reproductive age, and overweight adult women. Overweight and obesity among adults are at record levels with 38.9% of adults overweight or obese, stretching from Africa to North America, and increasing among adolescents. Women have a higher burden than men when it comes to certain forms of malnutrition: one third of all women of reproductive age have anaemia and women have a higher prevalence of obesity than men. Millions of women are still underweight.

The Body Mass Index (BMI) is an indicator of overall adiposity and low BMI and high levels of undernutrition (based on BMI) is a major public health problem especially among rural underprivileged adults of developing countries (World Health Organization, 1995). BMI provides the most useful population-level measure of overweight and obesity as it is the same for both sexes and for all ages of adults. Adult nutritional status can be evaluated in many ways but the BMI is most widely used indicator for assessing nutritional

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status of adults because its use is inexpensive, non-invasive and suitable for large-scale surveys (Lohman et al., 1988; Ferro-Luzzi et al., 1992; James et al., 1994). Thus, BMI is the most established anthropometric indicator used for assessment of adult nutritional status (Lee and Nieman, 2003). BMI is generally considered a good indicator of not only the nutritional status but also the socio-economic condition of a population, especially adult populations of developing countries (Ferro-Luzzi et al., 1992; Shetty and James, 1994; Nube et al., 1998; Khongsdier, 2002). BMI <18.5 kg/m² is considered an indicator of undernutrition and it predicts an individual's morbidity or other physiological and functional impairments (World Health Organization, 1995). Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. BMI >25.00 kg/m² is considered an indicator of overweight or obesity (WHO, 1995) and it increases the risk of diseases like coronary heart disease, ischemic stroke, type 2 diabetes mellitus, breast and other common cancers. Obesity is increasing at a rapid pace throughout the world. It is estimated that at present, more than 300 million people are obese and over 1.5 billion are overweight worldwide (The Global Challenge of Obesity and International Obesity Task, 2016). Many low and middle income countries are now facing a "double burden" of diseases with a rapid upsurge in Noncommunicable Disease (NCD) risk factors such as overweight and obesity apart from existing infectious disease and undernutrition. Overweight and obesity are major risk factors for a number of chronic diseases; around 44% of diabetes, 23% of ischemic heart disease, and 7%-41% of certain cancer burdens are attributable to overweight and obesity (WHO, 2015).

Mid Upper Arm Circumference (MUAC) is also an important indicator to assess the adult nutritional status. The assessment of adult nutritional status using MUAC requires no equipment apart from a tape measure. As the index is the actual measurement itself, mathematical manipulation of the measurement obtained is not necessary. MUAC has emerged in the literature as a potential screening tool for poor nutritional status (James et al. 1994) analyzed its usefulness in adults, and calculated cut-off equivalent to Body Mass Index (BMI) and cut-off for Chronic Energy Deficiency (CED), using a range of data sets from developing countries. MUAC is an appropriate indicator for the assessment of acute adult under-nutrition (Chakraorty et al. 2011). This is an indicator of low BMI in population screening for undernutrition (Das et al. 2018).

There are several studies on nutritional status based on BMI (undernutrition, overweight and obesity) among adults in India as well as in West Bengal (James et al., 2004; Flegal et al. 2013; Jose S, 2011; Caufield et al. 2004; Siddiqui et al. 2017;

James et al. 1994; Nubé et al. 1998; Shetty et al. 1994; Khongsdier R., 2002; Bose et al 2009; Khongsdier, 2002; Pryer et al. 2006; Clusen et al. 2006; Sarkar, R. 2016; Shetty et al. 1994; Mandal et al. 2011; Datta Banik et al. 2007; Ghosh et al. 2015; Sardar et al. 2018; Karmakar et al. 2019). There are also several studies on the association between nutritional status and socio economic factors among adults (Chakraborty et al. 2009; Mungreiphy et. al. 2010; Tigga et al. 2018).

There has been no study so far to assess the nutritional status among the adults Muslim of Nandigram I Block. In view of this context, the present study has been conducted to report the prevalence of undernutrition as well as overnutrition (overweight and/or obese) based on BMI and its association with some socioeconomic status. Present study also investigated undernutrition based on MUAC among the Bengalee Muslim adults of Nandigram I Block of Purba Medinipur district of West Bengal, India.

MATERIALS AND METHODS

Study Area and Population

The present investigation was carried out by field survey among rural Bengali adult Muslims in Nandigram-I block. Nandigram-I block is located approximately 39 KM towards South from district head quarters Tamluk and 128 kms from Kolkata, the provincial capital of West Bengal. For convenience and operational difficulties no strict sampling method had been applied (Khongsdier R 2002, Chakraborty et al. 2011, Das et al. 2018). Eight villages (near and surroundings of Nandigram police station) has been selected for this investigation. The total study sample size was 645 Bengalee Muslim adults who speak in Bengali (Males: n=279 and Females: n=366). Verbal consent has been taken from each participant before commencement of the study. Healthy respondents has been selected and studied randomly from the villages. The age range of this study was 18 years to 70 years. Overall response rate was found to be around 80%.

Socio Economic Variables

Age, monthly family income, educational level, house type, type of family were recorded by structured interview and schedule method to determine the socio-economic condition of the participants. All the respondents were classified into five age groups, followed by previous studies (Das et al. 2016, Karmakar et al. 2019, Das et al. 2020). The groups were 18-29.9 (males=109, females=136) years, 30-39.9 (males=59, females=87) years, 40-49.9 (males=46, females=67) years, 50-59.9 (males=30, females=37) years, and >60 (males=35, females=39) years. Total monthly family income (MFI) was recorded in terms of the Indian currency of Rupees (Rs.). All the respondents were classified into three family income

groups (FIG) according to their monthly family income (MFI) as half of the participants family income was below Rs. 8001. FIG I: MFI < Rs. 8000, FIG II: MFI = Rs. 8001-15000 and FIG III: MFI > Rs. 15001. Educational level was recorded as 'illiterate' and 'literate'. The respondents, who could not read and write, were recorded as 'illiterate'. Literate was recorded the standard of class for which the respondent appeared the examination. Respondents, who read upto standard V, were considered as 'primary'. The ones, who passed Madhyamik examination, were considered as 'secondary'. The ones, who passed higher secondary examination or had other higher degree, were considered as 'higher secondary and above'. Family type was recorded as nuclear family (a couple and their depended children) and joint family (many generations living in the same household and share same kitchen). House type was recorded as kacha (Adults, who lived in mud with bamboo fenced house) and pucca (adults, who lived in brick wall house). Based on B.G. Prasad SES scale (2021), respondents were classified into five monthly per capita income groups (MPCIG), as Class I (MPCI > Rs. 7770), Class II (MPCI = Rs. 3808-7769), Class III (MPCI = Rs. 2253-3807), Class IV (MPCI = Rs. 1166-2252) and Class V (MPCI Rs. <1165).

Anthropometry and Nutritional Status

Three anthropometric variables have been used in the present report following standard procedure as recommended by Lohman et al. (1988). Height was measured to the nearest 0.1 cm using Martin's anthropometer. Body weight was recorded to nearest 0.5 kg on a conventional weighing scale. Circumference measurement was made to the nearest 0.1 cm using a flexible inelastic steel tape. Body mass index (BMI) – a popular indicator of generalised adiposity has been calculated following the formula of World Health Organization (1995), $BMI = \text{Weight (kg)}/\text{Height (m)}^2$. BMI (kg/m^2) cut-off points (WHO, 1995) were used for determine nutritional status as Undernutrition: $BMI < 18.5$; Normal: $BMI = 18.5 - 24.9$; Overweight: $BMI = 25.0 - 29.99$; Obese: $BMI > 30.0$. The following classification (WHO, 1995) according to percentage of a population with $BMI < 18.5 \text{ kg}/\text{m}^2$ was used: Low (5-9%): Warning sign, monitoring required; Medium (10-19%): Poor situation; High (20-39%): Serious situation; Very high (>40%): Critical situation. Internationally accepted cuts off values were used (James et al., 1994) for determine nutritional status according to MUAC as Undernutrition: $MUAC < 23 \text{ cm}$ (male), $MUAC < 22 \text{ cm}$ (female) and Normal: $MUAC > 23 \text{ cm}$ (male), $MUAC > 22 \text{ cm}$ (female).

Statistical Analysis

Intra-observer technical errors of measurements (TEM) were calculated at the preliminary stage of the interpretation, based

on replicate measurements on 30 random selected respondents. Descriptive statistics of mean and SD were calculated to describe the characteristics of the sample. T-test was calculated to see the sex differences of mean age and anthropometric characteristics. Chi-square (χ^2) analysis was applied to assess significant differences in nutritional status (undernutrition and overweight/obese) with age groups, different socio-economic variables and MUAC categories. All statistical analyses were performed using the SPSS version 10 and $p < 0.05$ was considered as statistically significant.

RESULTS

Age and Socio-economic Characteristics

Frequency and percentage of age groups, monthly family income groups, education, family type, type of house and monthly per capita income groups of the participants are shown in Table 1. Percentage (%) of 1st age group of males and females were 39.1% and 37.2% respectively and respondents of this age group were higher than other age groups. Percentage of last age group (>60 years) of male and females were 12.5% and 10.7% respectively. Lower prevalence of males and females were (10.8% and 10.1%), respectively in the 4th age group (50-59.9 years) compared with other age groups. Higher frequency (%) of monthly family income (MFI) of both males and females were 50.2% and 58.5%, respectively in MFIG I (MFI Rs. < 8000). Lower frequency (%) of monthly family income (MFI) of both males and females were 20.8% and 13.1%, respectively in MFIG III (MFI > Rs. 15001). Approximately 50 percent adult Muslims monthly family income was below Rs. 8001 which had in the lowest income group. In male respondents, 24% were illiterate and 76% were literate. Out of 76% literate males, 29%, 35.5% and 11.5% respondents had primary education, secondary education and higher secondary or above education, respectively. In female respondents, 21.9% were illiterate and 78.1% were literate. Out of 78.1% literate females, 23%, 44.5% and 10.7% had primary education, secondary education and higher secondary or above education, respectively. 63.1% male and 61.2% female participants lived in nuclear family. 54.1% male and 53.0% female respondents lived in kacha house. Higher prevalence of monthly per capita income (MPCI) of males and females were in socioeconomic class IV (46.2% and 45.6%), respectively.

Anthropometric Characteristics

Mean (SD) of age, anthropometric characteristics and body mass index are shown in Table 2. The mean (SD) age of males and females were 37.80 (15.82) years and 37.25 (14.54) years, respectively. The mean (SD) height of the males and

Variables	Males (n=279)		Females (n=366)	
	n	%	n	%
Age groups (Years)				
18-29.9	109	39.1	136	37.2
30-39.9	59	21.1	87	23.8
40-49.9	46	16.5	67	18.3
50-59.9	30	10.8	37	10.1
≥60	35	12.5	39	10.7
Monthly family income groups				
MFI ≤ Rs. 8000	140	50.2	214	58.5
MFI = Rs. 8001 - 15000	81	29	104	28.4
MFI ≥ Rs. 15001	58	20.8	48	13.1
Education				
Illiterate	67	24	80	21.9
Primary	81	29	84	23
Secondary	99	35.5	163	44.5
Higher secondary or above	32	11.5	39	10.7
Family type				
Nuclear	176	63.1	224	61.2
Joint	103	36.9	142	38.8
House type				
Kacha	151	54.1	194	53.0
Pucca	128	45.9	172	47.0
Monthly per capita income groups (modified B.G. Prasad scale, 2021)				
Class I (MPCI ≥ Rs. 7770)	02	0.7	02	0.5
Class II (MPCI=Rs. 3808-7769)	17	6.1	16	4.4
Class III (MPCI= Rs. 2253-3807)	73	26.2	75	20.5
Class IV (MPCI= Rs. 1166-2252)	129	46.2	167	45.6
Class V (MPCI Rs. <1165)	58	20.8	106	29.0

Table 2: Descriptive Statistics of Anthropometric Characteristics of Adult Muslims

Variables	Mean (SD)		
	Males	Females	t-value
Age (Years)	37.80 (15.82)	37.25 (14.54)	-
Height (cm)	162.0 (6.1)	150.5 (5.9)	24.34*
Weight (kg)	58.2 (10.9)	52.6 (10.8)	6.55*
MUAC (cm)	26.1 (3.2)	25.7 (3.9)	1.21ns
BMI (kg/m ²)	22.17 (3.78)	23.19 (4.39)	3.10*

Note: *Significant at 0.05 level

females were 162.0 (6.1) cm and 150.2 (7.8) cm, respectively. The mean (SD) weight of the males and females were 58.2 (10.9) kg and 52.4 (11.1) kg, respectively. The mean (SD) MUAC of males and females were 26.1 (3.2) cm and 25.7 (3.9) cm, respectively. Mean (SD) BMI (kg/m²) of males and females were 22.17 (3.78) kg/m² and 23.19 (4.39) kg/m², respectively. Sex differences between the means of all anthropometric variables except MUAC were statistically significant (p<0.05).

Nutritional status by body mass index (BMI) and mid-upper arm circumference (MUAC)

Table 3 demonstrates overall frequency (%) of nutritional status according to international (WHO, 1995) classification and Asia specific classification (WHO, 2000). 16.1% male and 15.8% female respondents were undernutrition or chronic energy deficiency (CED). As per WHO international classification 14.3% and 4.3% males were overweight and obese whereas 20.1% and 18.6% males were overweight and obese (as per WHO Asia specific cut off points). Prevalence of overweight and obese in females was 20.1% and 18.6% (international classification) but as per Asia specific cut off

points it was 15% and 35%, respectively. Table 4 shows prevalence of nutritional status according to MUAC of respondents. 15.8% males (MUAC <23 cm) and 19.7% females (MUAC <22 cm) were undernourished whereas 84.2% males (MUAC > 23 cm) and 80.3% females (MUAC > 22 cm) were normal. Prevalence of undernutrition and overweight/obese of adults according to socio economic variables and MUAC categories is shown in Table 5. Higher prevalence of undernutrition (UN) and overweight/obese (ON) were 62.1% and 31.1% in the age group of 18-29.9 years and 30-39.9 years, respectively. The differences in prevalence of UN and ON with age groups was statistically significant ($\chi^2 = 47.37$, df = 4, P=0.000). Respondents who passed secondary education were more UN (37.9%) and ON (43.3%) than the respondents of other educational categories, these differences were statistically significant ($\chi^2 = 18.72$, df = 3, P=0.000). Respondents who lived in nuclear family and kacha house were more undernourished (61.2% and 55.3%) than the respondents who lived in joint family and pucca house. Higher prevalence of ON was found among respondents residing in nuclear family and pucca house (58.9% and 53.3%) as compared to the respondents residing in joint family and kacha house. However, these differences were not

Table 3: Overall frequency (%) of nutritional status according to International Classification (WHO, 1995) and Asia specific classification (WHO, 2000)

Nutritional Status	International classification (WHO, 1995)		Asia specific classification (WHO, 2000)	
	Male n (%)	Female n (%)	Male n (%)	Female n (%)
Underweight	45 (16.1)	58 (15.9)	45 (16.1)	58 (15.8)
Normal	182 (65.2)	180 (49.2)	126 (45.2)	125 (34.2)
Overweight	40 (14.3)	101 (27.6)	56 (20.1)	55 (15)
Obese	12 (4.3)	27 (7.4)	52 (18.6)	128 (35)

statistically significant. Respondents of 1st monthly family income group (MFI < Rs. 8000) was more UN (59.2%) and also was more ON (50.0%) but this association was not

statistically significant ($\chi^2 = 2.28$, $df = 2$, $P=0.320$). More UN and ON were found among the respondents from socio economic status of class IV (35.9% and 47.2%), these

Nutritional Status	Frequency (%)	
	Male	Female
Undernourished Men: MUAC <23 cm, Women: MUAC <22 cm)	44 (15.8)	72 (19.7)
Normal Men: MUAC > 23 cm, Women: MUAC > 22 cm)	235 (84.2)	294 (80.3)

Variables	Underweight n (%)	Overweight/obese n (%)	Chi-square,df,P
Age groups (Years)			
18-29.9	64 (62.1)	46 (25.6)	47.37, 4, 0.000
30-39.9	7 (6.8)	56 (31.1)	
40-49.9	10 (9.7)	37 (20.6)	
50-59.9	5 (4.9)	18 (10.0)	
≥60	17 (16.5)	23 (12.8)	
Education			
Illiterate	29 (28.2)	35 (19.4)	18.72, 3, 0.000
Primary	13 (12.6)	52 (28.9)	
Secondary	39 (37.9)	78 (43.3)	
Higher secondary or above	22 (21.4)	15 (8.3)	
Family type			
Nuclear	63 (61.2)	106 (58.9)	0.141, 1, 0.707
Joint	40 (38.8)	74 (41.1)	
House type			
Kacha	57 (55.3)	84 (46.7)	1.97, 1, 0.160
Pucca	46 (44.7)	96 (53.3)	
Monthly family income groups			
MFI ≤ Rs. 8000	61 (59.2)	90 (50.0)	2.28, 2, 0.320
MFI= Rs. 8001 - 15000	26 (25.2)	54 (30.0)	
MFI ≤ Rs. 15001	16 (15.5)	36 (20.0)	

Table 5 (Cont.)			
Variables	Underweight n (%)	Overweight/obese n (%)	Chi-square,df,P
Monthly per capita income groups			
Class I (MPCI \geq Rs. 7770)	0	4 (2.2)	16.99, 4, 0.002
Class II (MPCI = Rs. 3808-7769)	2 (1.9)	18 (10.0)	
Class III (MPCI= Rs. 2253-3807)	28 (27.2)	28 (15.6)	
Class IV (MPCI = Rs. 1166-2252)	37 (35.9)	85 (47.2)	
Class V (MPCI Rs. < 1165)	36 (35.0)	45 (25.0)	
MUAC Categories			
Undernutrition	84 (81.6)	2 (1.1)	20.04, 1, 0.000
Normal	19 (18.4)	178 (98.9)	

association was statistically significant ($\chi^2 = 16.99$, $df = 4$, $P=0.002$). Higher prevalence of UN (81.6%) and ON (98.9%) was seen among the undernourished and normal (According to MUAC) respondents, respectively. The association between UN and ON with MUAC categories were statistically significant ($\chi^2 = 20.04$, $df = 1$, $P=0.000$).

DISCUSSION

The present investigation was conducted to assess nutritional status and its association with socioeconomic variables among adult Bengalee Muslims who lived in Nandigram block, Purba Medinipur district, West Bengal, India. Assessment of nutritional status is an integral component for documenting the overall health of an individual and/or population, and is an indicator of the well-being of a particular region.

The mean of HT, WT and MUAC of male adults were significantly higher than female adults of present study whereas mean BMI of males were significantly ($P<0.01$) lower than female adults. Mean HT, WT and MUAC of males of recent studies (Deangan et al. 2010, Das et al. 2013, Das et al. 2016, Chakraborty R. 2011, Dutta Banik S et al. 2016, Dutta Banik S. 2016) were lower than the males of present study. Mean HT, WT and MUAC of females of several recent studies (Das et al. 2016, Dutta Banik S. 2016, Nag et al. 2015) were lower than the females of present study. Mean BMI (kg/m^2) of males and females of several recent studies (Das et al. 2016, Dutta Banik S. 2016) were lower than the males and females, separately of present study but mean BMI of present study of males and females were lower than the study of Nag et. al. 2015.

Overall prevalence of undernutrition of adult population of present investigation was lower but overweight/obese of

studied population was higher than rural adult Muslim population studied by Tigga et al. 2018. The prevalence of undernutrition of males and females of present study were lower but overweight were higher than recent studies (Das et al. 2016, Chakraborty et.al. 2011, Das et al. 2016, NFHS-4). Undernutrition based on MUAC was observed only 15.8 % of males and 19.7% of females; these values were lower than the slum dwellers of Midnapore (Das P. 2017).

My study showed that more participants were undernourished in the lower age group (<30 years) and this findings was similar to the recent studies by Tigga et al. 2018. Second age group (30-39.9 years) of this population was more overweight/obese, findings similar to Karmakar et al. 2019 but it was higher among rural Muslim population (Tigga et al. 2018) in the age group 40-49.9 years. Secondary passed respondents was more overweight in the present study but it was more in rural population of Singur (Karmakar et al. 2019). Majority of undernutrition and overweight respondents of present study were in lower socioeconomic groups (Class IV and V) and the association between socioeconomic status, UN and ON were statistically significant. These observations is similar to rural population of Singur (Karmakar et al. 2019) but the association between socioeconomic status and overweight and/or obesity was not statistically significant.

CONCLUSION

The present study does not report significantly ($P<0.05$) decreasing trend in mean height in males with the advancement of age but it shows a significantly increasing trend in mean height in females and mean weight in both males and females with the advancement of age. As a result

mean BMI value of both the sexes has significantly increased with their age advances. The prevalence of undernutrition of males and females were medium (16.1% and 15.9%) thus the situation is 'poor situation'. The prevalence of overweight of males and females were 14.3% and 27.6%, respectively. Coexistence of overnutrition and undernutrition (dual burden of malnutrition) were seen in the population. Females have a higher prevalence of undernutrition as well as overweight and obesity than males. Health-related interventions are needed for improvement of their nutritional situation. Further research is also needed to identify other factor(s) which was associated on malnutrition among the population. This observation of the present study may be helpful to help organize regular health checkup camps for identifying health problems among the individuals due to malnutrition.

RECOMMENDATION

There were lack of information of dietary pattern, other socio demographic characters and also lack of interpretation which relates undernutrition and overnutrition among adults.

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