



**Human Biology Review (ISSN 22774424) www.HumanBiologyJournal.com
International Peer Reviewed Journal of Biological Anthropology
Volume 14, Number 1, January-March 2025 Issue**

Original scientific paper

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Human Biology Review, Volume 14 (1), pp. 26-36.

Revised and accepted on January 08, 2025

Citation: Tamang C, Debnath M and Khatun A. 2025. Nutritional Status and its Associated Factors among Adult Nepali Women of Darjeeling, West Bengal, India. Human Biology Review, 14 (1), 26-36.

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ABSTRACT

The aim of the present cross-sectional study was to assess the nutritional status of the adult Nepali women of Darjeeling and to determine the factors associated with their nutritional status. Total sample size was 300 with an age range from 19-59 years living in the tea estate area of Darjeeling. Along with the socio-economic and demographic information three anthropometric measurements were taken (Height, weight and MUAC). The mean age, height, weight, BMI, and MUAC were 42.45 ± 11.05 years, 153.96 ± 8.17 cm, 53.03 ± 10.97 kg, 22.39 ± 4.39 kg/m², and 25.74 ± 2.89 cm respectively. The overall prevalence of underweight and overnutrition based on BMI cut off were 21.33% and 28% respectively, whereas, the % of undernutrition based on MUAC was 4.3%. It has also been found that the percentage prevalence of underweight was highest among the older age category and those who were either illiterate or can sign. Chi-square also reported age and education level (<0.05) as the significant determinants of underweight among the studied women. On the other hand, MUAC based undernutrition was found to be associated with marital status and education level (<0.05). In case of overnutrition, the significant contributors were number of children, family type, house type and tobacco-use (<0.05). From the findings of present study it is concluded that based on BMI cut off the nutritional status (in respect of underweight and overnutrition) of the present population is alarming in comparison to the MUAC based nutritional status. Proper nutritional intervention strategies and awareness will be helpful to fight with this condition.

Keywords: *Adult women, Nepali, BMI, MUAC, Nutrition, Darjeeling*

INTRODUCTION

Lack of proper nutrition results a state of imbalance in our body, which in turn causes malnutrition or diseases (Nakhro et al. 2022). Malnutrition, which is associated with adverse health outcomes, is defined by the presence of underweight coexisting with overweight/obesity, or sometimes referred to as the dual burden of malnutrition (Dutta et al. 2019). Body Mass Index is a globally used measure of the nutritional status of individual for both cross-sectional and longitudinal studies (Singh & Chattopadhyay 2024).

As per WHO estimation, the number of underweight adults was 462 million, and 1.9 million were overweight or obese (Mandal et al. 2023). Women's health and nutritional status are considered an important factor that not only contribute to maintaining a healthy family or children but also influence economic growth; it has been found that Indian women have been suffering from malnutrition for a longer time (Ghosh & Pal 2022) either due to self or family negligence. Al Kibria et al. (2019) analyzed the NFHS-4 (2015-16) data of 6, 47,168 Indian women, and reported that 22.9% were undernourished while the percentage of overweight and obese women were 22.6% and 10.7% respectively; the same study found young age, non-users of contraceptive, never married, being Hindu or from OBC caste, less educated, less wealthy and rural women have the tendency to be undernourished, while they found older age, ever-pregnant, ever-married, being Muslim or other castes (except OBC), higher education, wealthy and urban residents were overnourished. Nutrient deficiencies lead to underweight/undernutrition among women who have a greater risk of pregnancy outcomes like obstructed labor, giving birth to low birth weight babies, and ill health (Rai et al. 2018), and overweight leads to non-communicable diseases such as hypertension, type-2 diabetes, a pulmonary illness that affects the overall life qualities (Bhandari et al. 2021).

Studies have been conducted among the adult Indian population (/women) to find their nutritional status by different researchers (Mondal et al. 2017; Meitei & Singh 2019; Bhuyan et al. 2021; Rai & Singh 2021; Nakhro et al. 2022). Previous studies conducted among the adult women of Darjeeling reported a high prevalence of malnutrition among adult and/or elderly women (Pal & Ghosh 2022; Mandal et al. 2023; Sullar et al. 2023). The present study focused only on the nutritional status of adult women hence, the present study was conducted among adult Nepali women residing in the tea garden area of Darjeeling with the aim (1) to assess their nutritional status using BMI and Mid-upper arm circumference and also (2) to determine factors associated with their nutritional status.

MATERIAL AND METHODS

Study Area and subjects

This cross-sectional study was carried out among the Nepali women living in the area of Tongsong and Pussimbang Tea Estate, located near to Darjeeling town, West Bengal, India. Women of 18 years old and above were included in the study with an age range from 19 to 59 years. Prior to data collection consent was taken from the participants. Participants were selected by stratified random sampling method. The final sample size was 300. Data was collected during March, 2024.

Socio-economic, demographic, and lifestyle factor related data collection

To collect the background data related to their demographic or socio-economic or other characteristics, a pre-designed, structured interview schedule was used. This schedule contained so many variables such as age, caste, marital status, number of children, number of family members, family type, house type, source of drinking water, educational level, occupation, monthly income, and tobacco or alcohol consumption. Each variable was categorized into two or more types as per the frequency. The socio-economic class (based on monthly per capita income/MCPI) was determined by using modified BG Prasad classification for the year 2021 (Majhi& Bhatnagar, 2021).

Anthropometric measurements and assessment of nutritional status

Three anthropometric measurements were taken by the first author (CT) followed by standard technique (Lohman et al.1988) and using standard instrument. Height was measured in an erect position with the help of an anthropometer rod (nearest 0.1 cm), and weight was measured by BIA machine. For measuring the Mid-upper arm circumference (MUAC), a non-elastic tape was used. To assess the nutritional status of the participants, the WHO (1995), international cut off was utilized. BMI was calculated with the formula $BMI = \text{Weight (kg)}/\text{Height}^2 \text{ (m}^2\text{)}$. A BMI value <18.5 represents underweight while >25.0 and >30.0 classified as overweight and obese respectively. For MUAC based undernutrition the cut off <22 cm was considered (James et al. 1994).

Statistical analysis

All the statistical analyses were performed in SPSS software (v.26). Mean (standard deviation) and frequency distribution was calculated. Age-specific anthropometric variation was assessed by one-way ANOVA. To determine the association of nutritional status with various socio-economic, demographic and lifestyle factors chi square was utilized. The p value <0.05 and <0.01 were considered to be statistically significant.

RESULTS

The mean age of the Nepali women was 42.45 ± 11.06 years. Table 1 depicts the age-specific mean and standard deviation of different anthropometric (height, weight and MUAC) and derived variable (BMI) of the adult Nepali Women. Height showed an increase trend with the advancement of age upto 40-49 years and then it decreased. No age-specific variation was observed for this parameter. No such specific trend like the height was observed for other anthropometric and derived variables. But significant age variations were observed in case of weight ($F=3.958$; $p<0.01$) and BMI ($F=3.351$; $p<0.05$).

Table 1: Age-specific descriptive statistics [mean and standard deviation (SD)] of the anthropometric and derived variables

Variables	Age (Years)				Overall	F-value
	19-29	30-39	40-49	50-59		
	Mean \pm SD					
Height (cm)	153.89 \pm 7.96	154.31 \pm 7.90	154.97 \pm 8.80	152.98 \pm 7.91	153.96 \pm 8.17	0.946
Weight (kg)	54.49 \pm 12.37	56.10 \pm 9.71	52.85 \pm 10.81	50.50 \pm 10.68	53.03 \pm 10.97	3.958**
BMI (kg/m ²)	22.99 \pm 4.73	23.58 \pm 3.89	22.08 \pm 4.49	21.57 \pm 4.29	22.39 \pm 4.39	3.351*
MUAC (cm)	25.47 \pm 2.57	26.45 \pm 2.73	25.71 \pm 2.65	25.44 \pm 3.25	25.74 \pm 2.89	1.898

Significant at * $p < 0.05$; ** $p < 0.01$

The total number of underweight women was 64 out of 300 which represents 21.33% and the total number of women who were either overweight or obese 84 or 28% (figure 1). The prevalence of underweight among 19-29 age groups was 16.3%, for 30-39% was 10.6%, 40-49 years was 22.0% and for 50-59 years it was 30.1%. The prevalence of overweight in these age groups was 22.4%, 33.3% 17.1% and 18.4% respectively. Again the prevalence of obesity was 8.2%, 6.1%, 4.9% and 5.8% respectively in case of the above said age groups. As shown in figure 2 the prevalence of MUAC based undernutrition for our population was 4.3% (13 women out of 300).

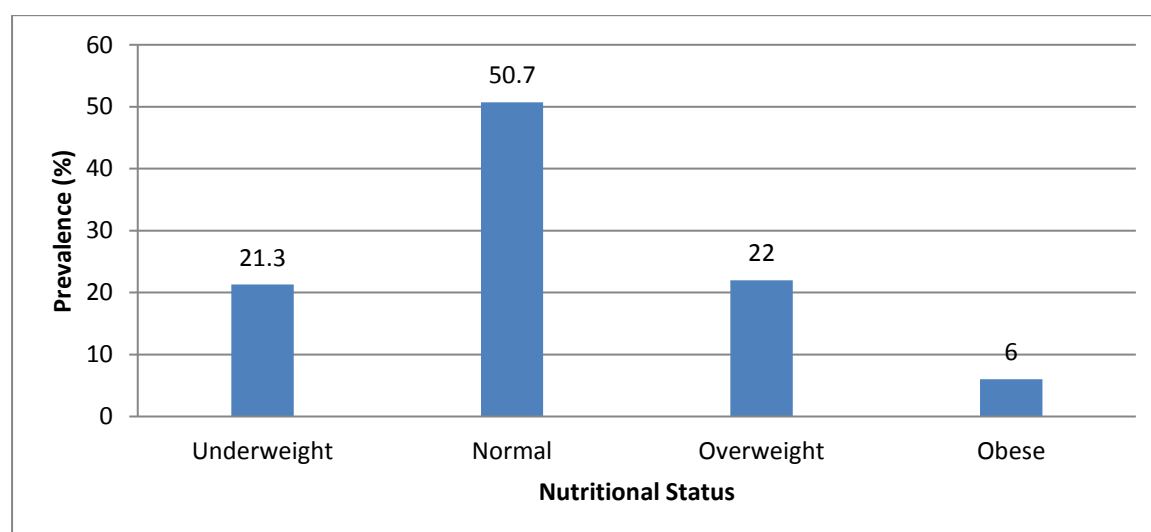


Figure 1: Nutritional status (%) of the studied Nepali women according to BMI cut off.

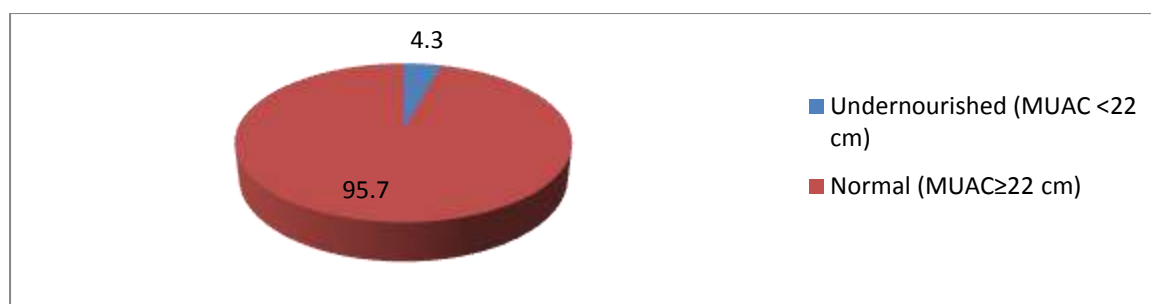


Figure 2: Nutritional status (%) of the studied Nepali women according to the MUAC cut-off.

Table 2 represents the distribution of participants according to the number and percentage of nutritional status in each category of the socio-economic, demographic and other variables considered for this study. Chi square analysis has been performed to identify the factors which are associated with undernutrition as well as overnutrition among the participants. It is seen that prevalence of underweight (a form of undernutrition) was more prevalent among older age group and those who were either illiterate or can sign and these two parameters (age & education level) were significantly associated, while Overweight/obesity was significantly associated with number of children (at $p < 0.05$), house type (at $p < 0.05$), family type (at $p < 0.05$), and tobacco consumption (at $p < 0.01$) (prevalence was more for those having ≥ 2 children, living in nuclear family as well as in pucca house followed by kutcha house and those who did not take tobacco). On the other hand, the MUAC based undernutrition was significantly associated with the marital status, type of family and education level (at $p < 0.05$).

Table 2: Association of different socio-economic, demographic and other factors with nutritional status of the studied women (using χ^2)

Variables	Category	Nutritional Status					
		Based on BMI				Based on MUAC	
		Underweight	χ^2	Overweight/ Obese	χ^2	Undernutrition	χ^2
Age (years)	19-29	8 (16.3)	9.990* p=0.019	15 (30.6)	6.614 p=0.085	0 (0.0)	6.472 p=0.091
	30-39	7 (10.6)		26 (39.4)		1 (1.5)	
	40-49	18 (22.0)		18 (22.0)		4 (4.9)	
	50-59	31 (30.1)		25 (24.3)		8 (7.8)	
Caste	ST	20 (26.3)	4.965 p=0.174	22 (28.9)	1.114 p=0.774	2 (2.6)	3.569 p=0.312
	SC	6 (35.3)		5 (29.4)		2 (11.8)	
	OBC	27 (17.0)		41 (25.8)		8 (5.0)	
	GENERAL	11 (22.9)		16 (33.3)		1 (2.1)	
Marital Status	Unmarried	10 (18.5)	0.917 p=0.632	16 (29.6)	0.240 p=0.887	1 (1.8)	8.951* p=0.011
	Married	49 (21.4)		64 (27.9)		9 (3.9)	

	Widow	5 (29.4)		4 (23.5)		3 (18.8)	
No of Children	Only 1	23 (25.8)	1.613	15 (16.9)	8.316*	2 (2.2)	2.811
	≥2	28 (20.0)	p=0.446	48 (34.3)	p=0.016	9 (6.4)	p=0.245
	No Child	13 (18.3)		21 (29.6)		2 (2.8)	
No of Family Members	≤4	42 (20.1)	0.629	59 (28.2)	0.018	10 (4.8)	0.339
	≥5	22 (24.2)	p=0.428	25 (27.5)	p=0.893	3 (3.3)	p=0.561
Family Type	Nuclear	37 (22.4)	0.260	54 (32.7)	4.064*	11 (6.7)	4.816*
	Joint	27 (20.0)	p=0.610	30 (22.7)	p=0.044	2 (1.5)	p=0.028
House Type	Kutchha	0 (0.0)	4.193	1 (50.0)	9.032*	0 (0.0)	0.703
	Semi-pucca	59 (23.4)	p=0.123	62 (24.6)	p=0.011	10 (4.0)	p=0.704
	Pucca	5 (10.9)		21 (45.7)		3 (6.5)	
Source of Drinking Water	Tap	5 (35.4)	1.810	5 (35.7)	0.430	1 (7.1)	0.280
	Spring Water	59 (20.6)	p=0.179	79 (27.6)	p=0.510	12 (4.2)	p=0.591
Education Level	Illiterate/can sign	14 (46.7)	12.824** p=0.005	7 (23.3)	1.182 p=0.757	2 (6.7)	12.232** p=0.007
	Primary	1 (14.3)		1 (14.3)		0 (0.0)	
	Secondary	6 (18.8)		10 (31.3)		5 (15.6)	
	HS and Above	43 (18.6)		60 (28.6)		6 (2.6)	
Occupation	Tea Leaf Plucking	63 (21.7)	0.792	81 (27.9)	0.021	12 (4.1)	0.801
	Factory & Others	1 (10.0)	p=0.374	3 (30.0)	p=0.886	1 (10.0)	p=0.371
No of Earning Members	Only 1	8 (14.3)	2.038	16 (28.6)	0.011	4 (7.1)	1.311
	≥2	56 (23.0)	p=0.153	68 (27.9)	p=0.916	9 (3.7)	p=0.252
MCPI (Rs)	Class I (≥7863)	11 (23.4)	5.486 p=0.139	13 (27.7)	2.943 p=0.400	2 (4.3)	0.793 p=0.851
	Class II (3931-7862)	36 (26.5)		38 (27.9)		5 (3.7)	
	Class III (2359-3930)	18 (14.5)		33 (30.0)		6 (5.5)	
	Class IV (1179-2358)	1 (14.3)		0 (0.0)		0 (0.0)	
Tobacco	Yes	26 (40.6)	3.014	16 (16.8)	8.585**	7 (3.4)	1.318
	No	38 (59.4)	p=0.082	68 (33.2)	p=0.003	6 (6.3)	p=0.251
Alcohol	Yes	14 (25.0)	0.552	10 (17.9)	3.514	10 (4.1)	0.174
	No	50 (20.5)	p=0.458	74 (30.3)	p=0.061	3 (5.4)	p=0.677

Significant at * p<0.05; **p<0.01

DISCUSSION

Present investigation showed a brief account of the participant's background characteristics, anthropometric characteristic and overall nutritional status and its significant association with different factors. The prevalence of underweight, overweight, and obesity in our population was found 21.33%, 22% and 6% respectively. The prevalence of underweight/undernutrition among the Nepali women (10%) of Karseong (Pal & Ghosh 2022) was low in comparison to the present women, but it was very high among the tea garden women (Sullar et al. 2023) of Naxalbari region (76.1%). Comparatively our study participants were more overweight/obese (combined) than the previous study population of Darjeeling district. Details are given in Table 3.

Kundu and De (2016) conducted a study among adult female tribes of Jhargram, West Bengal, where, they found 33.3 % Lodha women and 8.7% Santal women were undernourished and the prevalence of overweight among Santal women was 3%. Another study by Khatun (2022) among adult Muslim population of Nandigram reported 15.9% underweight prevalence and 35% combined prevalence of overweight/obesity among the women. This study also reported 19.7% undernutrition prevalence among the women assessed by MUAC cut of, while our study reported 4.3% prevalence of undernutrition determined by MUAC cut off for adults. An analysis of the NHFS-5 data in respect of different district of West Bengal by (Ghosh & Pal 2022) reported that the prevalence of underweight among women has decreased from the NHFS-4 but the rate of obesity has increased in most of the district except the southern region. Table 4 represents comparison of the nutritional prevalence of present population and other adult women of Eastern and Northeastern India. The prevalence of underweight was more among the Lodha (68.7%) of Odisha (Bhuyan et al. 2021) from our study population. The prevalence of overweight was more among the Garo women of Meghalaya (Nakhro et al. 2022) from our study participants, while the overall prevalence of overweight/obesity was high from our studied women among the urban women of Sikkim (Rai & Singh, 2021).

Table 3: Comparison of nutritional status of present population with other study population conducted in either on Nepali people or tea garden workers of Darjeeling

Authors	Study area & Population	Sample size (consider women only)	Age (years)	Prevalence of Nutritional Status (%)		
				Underweight/Undernutrition	Overweight	Obesity
Pal & Ghosh (2022)	Adult Nepalese, Karseong	57	18-80	10.0	14.28	10.52

Mandal et al. (2023)	Tea garden workers	120	18-64	30.0	20.8 (combined)	
Sullar et al. (2023)	Tea garden of Naxalbari	210	60+	76.1	-	-
Present study	Tea garden area, Nepali women	300	19-59	21.33	22.0	6.0

Table 4: Comparison of the nutritional status of present studied women with other Eastern and Northeastern Indian women

Authors	Study area & Population	Sample size	Age (years)	Prevalence of Nutritional Status (%)		
				Underweight/ Undernutrition	Overweight	Obesity
Mondal et al. (2017)	Karbi women, Assam	600	20-49	-	17.33	14.33
Meitei & Singh (2019)	Stone crushers, Manipur	290	18+	7.93	17.93	2.41
Bhuyan et al. (2021)	Lodha women, Odisha	300	18-45	68.7	2.0 (combined)	
Rai & Singh, (2021)	Urban women, Sikkim	657	20-60	4.7	30.4	15.1
Nakhro et al. (2022)	Garo women, Meghalaya	43	-	12.3	35.1	-
Present study	Tea garden area, Nepali women	300	19-59	21.33	22.0	6.0

Our findings suggested education level as an important determinant of underweight as well as undernutrition (based on MUAC). Four variables such as, number of children, family type, house type and tobacco use has been found to be significant factor for overweight and obesity among the Nepali women of Darjeeling. Previous studies from Darjeeling reported increasing age, being a permanent employee of the tea garden, educational level and household security was the determinant factors for malnutrition (Mandal et al. 2023) while other study from the same district found current marital status, current working status, education and caregiver as the significant factors for nutritional status of the elderly women of tea gardens (Sullar et al. 2023). Again age, income, education was reported a significant factors for malnutrition among the adult Muslim women of West Bengal by Khatun (2022). Mondal et al. (2017) also found age, family size, number of dependent children, tobacco use and alcohol consumption as a correlates of overweight/obesity among women while another study reported marital status, age, education, occupation and income as the associated factors of overnutrition among adult women (Rai & Singh, 2021). Though the present study assessed the nutritional status and associated factors among the studied participants but this study has some limitations- (1) the

sample size was small, (2) cross-sectional design of the study, (3) lack of information regarding dietary habits that may affect the overall nutritional condition of the participants.

CONCLUSION

Present findings concluded that the overall nutritional status of the women was not in a good situation. Almost half of the participants (49.33%) were malnourished (i.e., either underweight or overweight/obese). MUAC represents 4.3% undernutrition among the women. Age, marital status, number of children, family type, house type, education level, and tobacco were the most significant determinants of the nutritional status of present studied population. Nutritional awareness and healthy dietary habits with exercise can be fruitful to change the scenario.

Acknowledgement: Authors are thankful to all the women participated in this study along with the Department of Anthropology, University of North Bengal.

Conflict of Interest: Authors declare no conflict of interest.

Funding: Nil.

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