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Research Article

Obesity and Age Trend among Rural Adults of Daspur I Block, Paschim Medinipur, West Bengal

Mahua Chanak and Kaushik Bose*

Department of Anthropology, Vidyasagar University, India

***Corresponding author:** Kaushik Bose, Department of Anthropology, Vidyasagar University, Midnapore, West Bengal, India

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Abstract

Background: Obesity is considered a major health problem in both developed and developing countries. Excess weight is one of the leading causes of morbidity and mortality, and it is increasing substantially worldwide. Once considered a high-income country problem, obesity and overweight are now on the rise in low- and middle-income countries. The objective of the present study was to know the prevalence of overall obesity (BMI≥25.0) and central obesity among rural adults. The present study investigated the effect of different age groups (years) on the anthropometric and derived variables and also determined the age trend on obesity among rural adults of Daspur I block, Paschim Medinipur.

Materials and Methods: A community based cross-sectional study was conducted among 805 rural adults (Males=396; Females=409) of Daspur I block, Paschim Medinipur district, West Bengal, from August to December 2019.

Results: In the present study, the total prevalence of overall obesity was 22.4% (19.7% in males and 24.9% in females). The prevalence of central obesity was 45.3% (based on waist circumference), 73.8% (based on waist hip ratio), 65.1% (based on waist height ratio) and 72.3% (based on conicity index) among both sexes. The prevalence of both overall obesity and central obesity was much higher in case of female participants. Obesity (both) was more among females in the age group 31-49 (years) but among males it was ≥50 (years).

Conclusion: Our study revealed a high prevalence of central obesity among rural adults. In overall, the risk of obesity was greater in females. There was a significant association between age and being obese.

Keywords: Obesity; Central Obesity; Rural Adults; Age Group; Waist Circumference; Waist Hip Ratio; Waist Height Ratio; Conicity Index

Introduction

Obesity is considered a major health problem in both developed and developing countries [1-3]. Excess weight is one of the leading causes of morbidity and mortality, and it is increasing substantially worldwide [4-6]. Once considered a high-income country problem, obesity and overweight are now on rise in low- and middle-income countries [7]. In countries with low-income, obesity mostly affects middle-aged adults (especially women) from wealthy, urban environments, whereas in high income countries, it affects both sexes for all ages, but it is disproportionately more common in disadvantaged groups [6,8]. Central obesity (CO) and overall obesity has been associated with an increase in age and it is more prevalent in females [6,9-12]. One in three adults of normal weight had CO [13]. Overall obesity poses a significant threat to human health, and distribution of body fat is one of the major parameters for determining this threat [13-15]. Obesity bestows cardio-metabolic diseases and CO is a better predictor of cardiovascular risk than overall obesity [13,16-17]. Overweight and obesity increases the risk of several types of cancers (especially breast cancer among females) and raise cholesterol, insulin resistance and blood pressure [18-20]. With increase in abdominal fat, the risk of CO and associated ailments increases [13,16]. Therefore, abdominal fat deposition measured by waist circumference (WC) has been recommended as a better indicator of obesity in relation to metabolic syndrome, cardiovascular diseases, and type 2 diabetes compared to body mass index (BMI) [21,6]. Along with gender, lifestyle habits like intake of high protein diet, more restaurant visits, less homemade tiffin intake, alcohol consumption were found to be significantly associated with obesity. Intake of fish, day-time sleep physical activity, high protein diet, were also found to be significantly correlated to normal-weight obesity [22]. Hypertension, diabetes and hyperlipidemia were significantly associated with CO among adults with normal BMI [23]. Increased age, urban residence, less walking per day, more time spent on television and being married were all associated with having CO

among adults [11]. Family history of obesity and fatigue were risk factors for obesity [24]. Recent studies emerging from different countries of world have shown that obesity may be an independent factor to predict the risk and outcome of COVID-19 patients [25-31].

Approximately 39.0% of the global adult population were classified as overweight (BMI 25.0–29.9 kg/m^2) or obese (BMI > 29.9kg/m^2) in 2014; a doubling since 1975 [32]. Since 1975, worldwide obesity has nearly tripled in numbers [7]. In 1975, the prevalence of obesity was 6.4% among females and 3.2% among males, whereas it had risen to 14.9% and 10.8%, respectively by 2014 [32,33]. In 2016, more than 1.9 billion adults (18 years and older) were overweight and over 650 million were obese, out of which over 340 million children and adolescents aged 5-19 were overweight or obese. In 2016, the prevalence of obesity and overweight among adults were 13.0% and 39.0%, respectively. Most of the world's population live in countries where the mortality rate due to obesity and overweight is more than underweight. In 2019, 38 million children under the age of 5 were obese and overweight. Globally there are more people who are obese than underweight-this happens in every part except parts of Sub-Saharan Africa and Asia [7]. In developing countries like India, the increasing prevalence of overweight and obesity has coincided with the demographic and epidemiological transitions, where mortality and fertility have declined, and lifestyle-related diseases have become more common [33-36]. The prevalence of overweight and obesity in India is alarmingly growing faster than the global average. For instance, the prevalence of overweight increased significantly from 8.4% to 15.5% among females between 1998 and 2015, and the prevalence of obesity increased from 2.2% to 5.1% over the same period [33,37-39]. Despite the above figures, only a few studies have attempted to estimate future trends in overweight and obesity in India. One study that reports on global trends estimated that by 2030, 27.8% of all Indians would be overweight, and 5.0% obese [33,40]. Another study estimated that around 20.0% of rural Indian adults will be either overweight or obese by 2030 [41,33]. There are fewer studies about the impact of obesity in rural adults compared to urban adults. Many national and international studies have accounted for both overall as well as CO, but such investigations are lacking from rural West Bengal. Our study reports the prevalence and age trend of obesity (overall and CO) among rural adults of Daspur I block, Paschim Medinipur, West Bengal.

Materials and Methods

It was a community based cross-sectional study conducted among rural adults of Daspur I block, Paschim Medinipur district, West Bengal. Data collection was done from August to December, 2019. The participants were selected from 4 villages (Rajnagar, Gokulnagar, Jadupur, Ramdebpur) under Daspur I block of Paschim Medinipur district, West Bengal, India. A total of 805 rural adults (Male=396, Female=409), aged above 18 years in those villages were included in this study. Consent was taken from the villagers by explaining the purpose of the study and those who had shown interest in participation were included in the present study. Verbal consent has been taken from each participant before initiating the study. None of the participants had any physical deformity. Age (years) of the participants was recorded from identity proofs issued by the Government. All anthropometric measurements were taken by the first author (MC) using standard procedures [42] (Lohman et al. 1988). Height [HT (cm)], weight [WT (kg)], waist circumference [WC (cm)], hip circumference [HC (cm)] were measured. Height (cm) was measured using Martin's anthropometric rod to the nearest 0.10 cm. The participants were asked to stand upright without shoes, heels together and eyes directed forward. Weight (kg) was measured with a portable weighing machine that was kept on a firm horizontal flat surface. Participants were asked to wear light clothing, and weight was recorded to the nearest 0.5 kg. Waist circumference (cm) and HC (cm) were measured using a non-stretchable measuring tape. The technical error of measurement (TEM) of anthropometric measurements was calculated using the standard procedure [43]. For calculating TEM, a total of 50 adults were selected randomly from studied area. The TEM was calculated using the following standard equation:

$$\mathbf{TEM= \sqrt{(\Sigma D2 /2N)}}$$

where: D-difference between the measurements, N-number of individuals.

The coefficient of reliability (R) was calculated from TEM using the following standard equation: R= 1−(TEM)2/SD2 where: SD-standard deviation of the measurements. The values of 'R' were subsequently determined from TEM. The intra-observer and inter-observer TEM values were observed to be within the cut-off value (R=0.95) as recommended [43].

Body Mass Index (BMI), WHR, WHtR and CI were calculated following these formulae:

BMI = Weight (kg) / Height (m^2).

WHR = WC (cm) / HC (cm).

WHtR = WC (cm) / HT (cm).

CI = WC (m) / 0.109 × $\sqrt{}$ WT (kg) / HT (m) [44].

To determine the frequency of BMI (kg/m^2) based obesity and central obesity the following standard cut-off values were used in Table 5. One way ANOVA test was performed to test for significant differences in anthropometric and derived variables between age groups among the studied participants. Chi- square (x^2) was performed to test for sex differences in the prevalence of BMI based obesity and CO; Chi-square (x^2) test was also analysed to find out the association of obesity (both overall and central obesity) with age among both sexes. Age groups were prepared using percentiles (25th and 50th). The total population was categorized into 3 age groups: lower age group: ≤ 30 years, middle age group: 31-49 years and upper age group: ≥ 50 years for further analysis. A p-value of 0.05 was considered to be statistically significant. All the statistical analyses were conducted in SPSS version 16.0.

Results

Descriptive statistics (Mean±SD) of anthropometric and derived variables among participants are presented in Table 1. Mean HT (cm), WT (kg), WC (cm) and WHR were found to be more among males than females. Mean HC (cm), BMI (kg/m^2), WHtR were higher in females than in males. By using independent sample t-test, it was observed that there were significant statistical differences between both sexes in HT (cm) ($p<0.001$), WT (kg) ($p<0.001$), HC (cm) ($p<0.001$), BMI (kg/m^2) ($p<0.01$), WHR ($p<0.001$), WHtR ($p<0.001$). Details of age group (years) specific anthropometric and derived variables (Mean ± SD) among the participants are presented in Table 2. Mean HT (cm) for both sexes decreased from lower (≤30 years) to upper age group (≥50 years). Mean WT (kg) and BMI (kg/m^2) among both sexes was more in middle age group (31-49 years). Mean WC (cm), HC (cm), WHtR were more in middle age group (31-49 years) among female participants. Mean values of WC (cm), WHR, WHtR, CI increased from lower (≤30 years) to middle (31-49 years) and middle (31-49 years) to upper age group (≥50 years) among males. Mean HC (cm) was more among middle aged (31-49 years) males. Table 3 presents the prevalence of overall obesity and CO among the participants. It was found out that the prevalence of overall obesity (24.9% vs. 19.7) and CO was more among female participants (60.4% vs. 29.8%; 80.2% vs. 67.2%; 72.6% vs. 57.3%; 84.4% vs. 59.8%). The difference between sex and CO was highly significant ($p< 0.001$) however no significant ($p>0.05$) difference was observed between overall obesity and sex. Age group specific distribution of overall obesity and CO among the participants is presented in Table 4. The prevalence of obesity (based on BMI) among males and females were more in the age group of 31-49 years. Among males, the prevalence of CO increased with increasing age, but among females, prevalence of CO was high in middle age group (31-49 years). It was also found out that the prevalence of WHR increased with increasing age (years) for females. The association of age (years) and obesity among female participants were significantly high ($p<0.001$). There was a significant association between CO and age among both sexes.

Table 1: Descriptive statistics (Mean ± SD) of anthropometric and derived variables among the participants.

Variables	Sex		t
	Male (Mean±SD)	Female (Mean±SD)	
HT (cm)	163.73±6.53	150.53±6.50	28.751***
WT (cm)	58.74±10.16	51.58±10.17	9.986***
WC (cm)	83.23±10.12	81.77±11.49	1.903N
HC (cm)	89.543±7.1697	91.92±10.30	-3.792***
BMI(kg/m^2)	21.91±3.57451	22.73±4.06	-3.029**
WHR	0.93±0.07	0.89±0.06	8.759***
WHtR	0.51±0.06	0.54±0.08	-7.018***
CI	1.28±0.08	1.28±0.10	-1.125N

(Mean± Standard deviation; Statistically significant at *** – p< 0.001, ** – p< 0.01and N – Not significant).

Table 2: Age group specific anthropometric and derived variables (Mean ± SD) among the participants.

Variables	Sex	Age Group (years)			F
		≤30	31-49	≥50	
HT (cm)	M	166.36±6.99	163.18±6.21	162.18±5.83	14.540***
	F	153.57±6.43	150.66±5.44	147.70±6.45	28.427***
WT (kg)	M	57.99±11.93	60.32±9.52	57.73±9.05	2.74N
	F	52.53±9.82	54.37±10.01	47.67±9.49	17.339***
WC (cm)	M	78.50±10.03	84.62±9.14	85.62±9.94	19.192***
	F	79.41±10.44	85.30±11.51	80.19±11.58	11.423***
HC (cm)	M	88.27±8.23	90.45±6.29	89.64±6.98	2.988N
	F	91.63±9.24	94.99±9.97	88.87±10.70	13.216***
BMI (kg/m^2)	M	20.88±3.75	22.66±3.42	21.97±3.40	8.156***
	F	22.29±3.76	22.30±4.16	21.81±3.92	11.299***
WHR	M	0.89±0.06	0.93±0.06	0.95±0.07	36.349***
	F	0.87±0.05	0.90±0.06	0.90±0.06	14.436***
WHtR	M	0.47±.05	0.52±0.06	0.53±0.06	31.919***
	F	0.52±0.06	0.57±0.08	0.54±0.08	14.752***
CI	M	1.22±0.07	1.28±0.08	1.32±0.09	47.258***
	F	1.25±0.09	1.30±0.09	1.30±0.10	12.389***

(Mean±Standard deviation; Statistically significant at *** – p< 0.001 and N – Not significant; M – Male, F – Female).

Table 3: Prevalence of overall obesity and CO among the participants.

Variables	Male	Female	Total	x^2
Overall obesity (BMI ≥25.0)	78 (19.7)	102 (24.9)	180 (22.4)	3.18^{N}
Central obesity (WC based)	118 (29.8)	247 (60.4)	365 (45.3)	75.983^{***}
Central obesity (WHR based)	266 (67.2)	328 (80.2)	594 (73.8)	17.645^{***}
Central obesity (WHtR based)	227 (57.3)	297 (72.6)	524 (65.1)	20.709^{***}
Central obesity (CI based)	237 (59.8)	345 (84.4)	582 (72.3)	60.318^{***}

(Percentages are presented in the parentheses; statistically significant at *** – p< 0.001 and N-Not significant).

Table 4: Age group specific distribution of overall obesity and CO among the participants.

Variables	Sex	Age Group (Years)			Total	x^2
		≤30	31-49	≥50		
Obesity (BMI ≥25.0)	M	19 (16.8)	34 (23.8)	25 (17.9)	78 (19.7)	2.398^{N}
	F	24 (18.8)	54 (37.0)	24 (17.8)	102 (24.9)	17.637^{***}
	T	43 (17.8)	88 (30.4)	49 (17.8)	180 (22.4)	16.996^{***}
Central obesity (WC based)	M	20 (17.7)	43 (30.1)	55 (39.3)	118 (29.8)	13.937^{***}
	F	68 (53.1)	108 (74.0)	71 (52.6)	247 (60.4)	17.516^{***}
	T	88 (36.5)	151 (52.2)	126 (45.8)	365 (45.3)	13.166^{**}
Central obesity (WHR based)	M	44 (38.9)	111 (77.6)	111 (79.3)	266 (67.2)	57.248^{***}
	F	84 (65.6)	125 (85.6)	119 (88.1)	328 (80.2)	25.187^{***}
	T	128 (53.1)	236 (81.7)	230 (83.6)	594 (73.8)	76.321^{***}
Central obesity (WHtR based)	M	37 (32.7)	92 (64.3)	98 (70.0)	227 (57.3)	39.978^{***}
	F	81 (63.3)	125 (85.6)	91 (67.4)	297 (72.6)	19.860^{***}
	T	118 (49.0)	217 (75.1)	189 (68.7)	524 (65.1)	41.898^{***}
Central obesity (CI based)	M	35 (31.0)	93 (65.0)	109 (77.9)	237 (59.8)	59.703^{***}
	F	98 (76.6)	132 (90.4)	115 (85.2)	345 (84.4)	10.016^{**}
	T	133 (55.2)	225 (77.9)	224 (81.5)	582 (72.3)	51.200^{***}

(Percentages are presented in the parentheses; statistically significant at *** – p< 0.001, ** – p< 0.01 and N – Not significant; M – Male, F – Female).

Table 5

Variables	Sex		Reference
	Male	Female	
BMI (kg/m^2)	≥25.00	≥25.00	WHO, 2000 [2]
WC (cm)	≥90.00	≥80.00	WHO, 2000 [3]
WHR	>0.95	>0.85	WHO, 1989 [45]
WHtR	≥0.50	≥0.50	Hsieh and Muto 2004 [46]
CI	≥1.25	≥1.18	Flora et al., 2009 [47]

Discussion

It is obvious from the present study that females possessed a higher risk for developing obesity more than males. The prevalence of obesity (BMI≥25 kg /m^2) was 22.4% (19.7% in males and 24.9% in females). The prevalence of obesity (22.4%) observed in this study was higher than some previous studies in India by [48] in Tamil Nadu (5.5%), [49] in a rural coastal area in South India (14.0%), [50] in rural Meerut (17.7%), [51] in rural Kerala (10.0%) but lower than some other studies done in Punjab (29.4%) by [12], in rural West Bengal (30.4%) by [52], in rural Andhra Pradesh (56.0%) by [53], in rural Pondicherry (27.3%) by Shrivastava et al. (2015) [54].Worldwide, (Nepal, Saudi Arabia, Ethiopia) numerous studies (Rawal et al., 2018, Al-Qahtani, 2019; Darebo et al., 2019) have been conducted by various scholars on the prevalence of obesity among adults and they have revealed a higher prevalence of obesity than our study. In China, a study by Zhang et al. (2016) has revealed a lower prevalence (14.6%) of obesity than the present study. According to our findings, the prevalence of obesity (based on BMI) was significantly higher among females. However, this finding was similar with previous studies in India [53], Ethiopia [19], Northeast China [55], and Saudi Arabia [56] as well; however, in China [57], Tanzania ([58]) the prevalence of obesity was higher in males. In India, obesity was also more common in females in Meerut [50], Punjab [12], Karnataka [59], Tamil Nadu [60], West Bengal [52]. Various scholars have found out in their studies that the prevalence of obesity was higher in males as compared to females [51,49,22].

Obesity have significant impact with age (years) among both sexes in this study. Among males, prevalence of overall obesity and CO increased from a lower age group (≤30 years) to upper age group (≥50 years) but in case of females, the prevalence increased from lower (≤30 years) to middle age group (31-49 years). The probability of getting obese with increase in age (years) is very high among males, however in case of female participants, middle aged individuals are more likely to get obese than older females as per the present study. Our study has highlighted that more female participants belonging to middle age (31–49 years) group were obese (overall obesity and CO) which was similar to the findings of some recent studies in Iran [61], Bangladesh [62], Nepal [63], India [53,52] but higher (≥50 years) age group was comparatively more obese in China [57], Syria [64] and in Sudan [6]. Age is a very important risk factor for both types of obesity. The prevalence of CO (based on WHR) was observed to be more in females (80.2%) than males (41.7%). In different regions of the world, such gender-based differences in CO prevalence have been reported in many previous studies. Similar findings were also observed in studies [66,13, 52] from different countries of the world such as Egypt (12.4% in males and 44.9% in females), South Africa (51.7% in males and 60.7% in females), India (62.7% in males and 92.3% in females). In Indian context (Kerala, Tamil Nadu, West Bengal), previous studies [66,49,20] have illustrated that CO was more prevalent in females than males. These findings were analogous to the present study. The prevalence of CO based on WHtR was higher among adult Spanish males [67].

The observed differences between the two sexes can be due to both social and biological factors. In developing countries males are more engaged in physical activities than females and hence they may have a reduced risk of obesity. Also there were many studies which suggested that female sex hormones have a great impact on deposition of fat, and thereby increased risk of obesity [68,69,19]. However, in this study the prevalence of CO in females may be due to sedentary lifestyle and practice of less physical activity since most females who live in developing countries, including India are housewives. Thus, they may spend more time at home with less physical activities [70, 71, 72].

Conclusion

The present study has demonstrated a strong relationship between age and obesity. An interesting finding is that the prevalence of obesity was higher among middle aged females and showed no increase with increasing age. The Government policy makers and other health related stakeholders should consider obesity as a growing public issue and therefore there is an urgent need for national awareness programs among rural population to reduce obesity and associated comorbidity and mortality.

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Statement of Conflict

The authors declare no conflict of interest.

Authors Contributions

MC designed the study and collected the data. Data entry and analyses were performed by her. She also prepared and edited the manuscript. KB designed the study, analysed the data and edited the manuscript.

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