International Journal of Community Medicine and Public Health
Yadav AR et al. Int J Community Med Public Health. 2026 Jul;13(7):3489-3496
https://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20262239

Original Research Article

Anthropometric indicators and determinants of body mass index of urban adult subjects: insights from community-based study

Ambika Rani Yadav, Priya Keshari

Department of Family and Community Sciences, Faculty of Science, University of Allahabad, Prayagraj, Uttar Pradesh, India

Received: 31 December 2025
Revised: 23 May 2026
Accepted: 26 May 2026

***Correspondence:**
Dr. Priya Keshari,
E-mail: priya.bhu2010@gmail.com

ABSTRACT

Background: Poor nutritional status is linked with hypertension, endothelial dysfunction and atherosclerosis, insulin resistance, inflammation, impaired glucose tolerance and hormonal imbalance. Aim of the study was to assess nutritional status of subjects based on anthropometric measurement and to find out linkages of body mass index.
Methods: This community based cross-sectional study was undertaken on urban adults of Prayagraj district, Uttar Pradesh, India. Multistage sampling procedure was adopted for selection of subjects. Information pertaining to sociodemographic characteristics was obtained by interviewing subjects using pre-designed pretested interview schedule. Assessment of anthropometric measurements and other nutritional parameters were done using standard techniques. Data were analysed using SPSS. For continuous variables, descriptive statistics were calculated. Linkage between body mass index and categorical variables were evaluated using the Chi-square test, with statistical significance at $p<0.05$.
Results: The average height and weight of subjects was 161.74±9.33 cm and 69.63±12.55 kg, respectively. As much as 47.6% and 12.9% were overweight (25-29.9 kg/m^2) and obese (≥30 kg/m^2), respectively. Gender, caste, marital status, education, occupation and socio-economic status, waist circumference, waist hip ratio, muscle mass, visceral fat, body fat percentage, energy intake and level of physical activity were significantly linked with body mass index.
Conclusions: High prevalence of overweight and obese subjects in this study underlines a shift toward nutritional excess, consistent with the nutrition transition. Tailored efforts at state levels are required to strengthen existing policies and develop new interventions to target both forms of malnutrition.

Keywords: Adult subjects, Body fat percent, Body mass index, Muscle mass, Urban setting, Visceral fat percent

INTRODUCTION

Nutritional status is a key indicator of health and well-being, reflecting the complex interaction between biological factors, dietary intake, socioeconomic conditions and lifestyle behaviours. Poor nutritional status is associated with various cardiovascular risk factors, including hypertension, endothelial dysfunction and atherosclerosis. Insulin resistance, inflammation, impaired glucose tolerance and hormonal imbalance (viz., thyroid dysfunction, polycystic ovary syndrome) are associated with elevated body mass index and central adiposity. Collectively these factors increase the risk of developing cardiovascular diseases and type 2 diabetes.[1,2]

Anthropometric indicators are vital tools for assessing nutritional status of populations. Body mass index (BMI) remains one of the most widely used metrics for evaluating the prevalence of underweight, overweight and obesity in adults. The trajectory of India's urbanization has intensified in recent decades, resulting in nearly 34% of its population living within urban areas.[3] Urban adult

population experience unique health challenges, including more exposure to energy dense foods, sedentary life style and socioeconomic disparities that influence food choices and physical activity patterns. These factors not only contribute to variability in anthropometric measures among adults but also affect food affordability and accessibility, nutrition knowledge, health-seeking behaviour and overall quality of life. Together, these interconnected factors shape the nutritional well-being of urban communities. Socio-demographic characteristics such as age, gender, education, income, occupation and socioeconomic status play critical roles in shaping nutritional outcomes. Additionally, dietary practices, physical activity levels and other lifestyle factors further influence body composition and BMI status.

Despite the increasing health challenges in urban adult populations due to poor nutritional status, there existed limited research focusing specifically on their anthropometric profiles and the determinants of body mass index. Existing evidence largely targets children, adolescents or rural communities, resulting in a gap in understanding how socio-demographic and lifestyle variables influence adult nutritional status in urban setting. The heterogeneity of urban populations with diverse socioeconomic backgrounds, occupations, dietary behaviour and physical activity context specific data essential for designing effective public health interventions tailored to the unique demands of urban communities and for informing public policy dialogue. With this background present study was carried out in urban adult population of Prayagraj district, Uttar Pradesh. Aim of the study was to assess nutritional status of subjects based on anthropometric measurement and to find out linkages of body mass index.

METHODS

Setting and study subjects

This cross-sectional study was undertaken in the urban areas of Prayagraj district, Uttar Pradesh, India. Subjects of the study were adult population aged 30-59 years residing in urban areas of Prayagraj.

Study design

Community based cross-sectional study design was adopted to carried out the study.

Study period

The study was carried out from February 2022 to June 2023.

Sample size

Based on the pilot study, taking prevalence of underweight (determined on the basis of body mass index) as 30% with permissible error as 5% the estimated sample size was 323. After accounting for a design effect of 1.5 this became 484.5. Taking non-response rate allowance of 10% the final sample size became 538. However, the study was conducted on 536 subjects as 2 subjects did not provide complete information.

Study subjects selection

Multistage sampling procedure was adopted for selection of sampling unit. The sample for the study was selected through the following steps: Prayagraj district → ward → mohalla → household → family→ subject.

Two out of the five zones in Prayagraj city were selected using simple random sampling. Households within the chosen zones were selected by systematic random sampling, with probability proportional to size. From each selected household, one family was chosen using the lottery method. Finally, one study subject from the chosen family was randomly selected using the lottery method.

Inclusion and exclusion criteria

Urban subjects of age group between 30 to 59 years consenting for the study were considered in study whereas, subjects residing less than 6 months in the study area or had any serious mental and physical health conditions were not included in the study.

Tools and techniques

Information pertaining to sociodemographic characteristics (viz. age, gender, marital status, religion, caste, education, occupation, family type, family size and socio-economic status) was obtained by interviewing subjects using pre-designed pretested interview schedule. The socioeconomic status (SES) of the study subjects was assessed using the Kuppuswamy socioeconomic status scale. This scale classifies socio economic status of family based on the three key parameters: (viz. education and occupation of the head of the family, and the total monthly family income). The cumulative score was used to categorize families into five socioeconomic classes, ranging from upper to lower socioeconomic status.[4]

Assessment of anthropometric measurements and other nutritional parameters (e.g. weight, visceral fat %, body fat %, muscle mass %) were done using Omron HBF-224 body composition monitor. Height and waist and hip circumference were measured using a stadiometer and non-stretchable tape, respectively. Body mass index (BMI) of study subjects was assessed by using World Health Organization (WHO) global classification. According to this classification, subjects were classified as underweight (<18.5 kg/m^2), normal (18.5-24.9 kg/m^2), overweight (25.0-29.9 kg/m^2) and obese (≥30.0 kg/m^2).[5] The waist hip ratio (WHR) of the study subjects was measured to assess the distribution of body fat. WHR was calculated by taking the ratio of waist circumference and

hip circumference. As per World Health Organization criteria, a WHR of >0.90 in men and >0.85 in women categorise as high WHR.[5]

Statistical analysis

Data were analysed using SPSS version 22. For continuous variables, descriptive statistics were calculated and presented as mean±standard deviation (SD). Linkage between body mass index and categorical variables were evaluated using the Chi-square test, with statistical significance set at $p<0.05$.

RESULTS

The anthropometric and body composition characteristics of the study population are given in Table 1. The average height and weight of subjects was 161.74±9.33 cm and 69.63±12.55 kg, respectively. Male had a mean waist circumference of 96.46±10.36 cm, while female had a slightly lower mean of 94.79±11.68 cm. overall this value was 95.71±10.99. Hip circumference differed between sexes, with male averaging 95.67±7.38 cm and female 100.41±11.81 cm. The average waist-to-hip ratio (WHR) was 1.01±0.06 for male and 0.95±0.06 for females, indicating differences in fat distribution between genders. The average BMI of subjects was 26.65±4.10 kg/m^2, with a mean body fat percentage of 31.33±13.10 and an average visceral fat percentage of 11.48±5.54. The mean muscle mass was 27.88±4.67 kg. Average daily energy intake was 2203.10±401.37 kcal.

Of all, 2.2% were underweight (<18.5 kg/m^2) and 37.3% had a normal BMI (18.5-24.9 kg/m^2). As much as 47.6% and 12.9% were overweight (25-29.9 kg/m^2) and obese (≥30 kg/m^2), respectively (Figure 1).

Table 1: Anthropometric indicators of study subjects.

Particulars	Mean	Std. deviation (±)
Height (cm)	161.74	9.33
Weight (kg)	69.63	12.55
Waist Circumference	95.71	10.99
Waist Circumference (cm)		
Male	96.46	10.36
Female	94.79	11.68
Hip circumference		
Male	95.67	7.38
Female	100.41	11.81
Waist-hip ratio		
Male	1.01	0.06
Female	0.945	0.06
Body mass index (BMI)	26.65	4.10
Body fat %	31.33	13.10
Visceral fat%	11.48	5.54
Muscle mass	27.88	4.67
Energy intake (Kcal)	2203.10	401.37

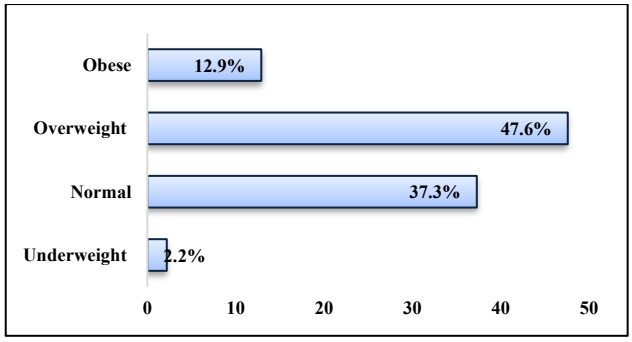

Figure 1: Status of body mass index of subjects.

The linkage of BMI with socio-demographic variables is depicted in Table 2. Gender, caste, marital status, education, occupation and socio-economic status were significantly linked with BMI, highlighting the influence of socio-demographic factors on overweight and obesity in the study population ($p<0.05$). As much as 59.1% male and 62.1% female were overweight or obese. Other caste category had the highest prevalence of overweight/obesity (64.9%) than Schedule caste/schedule tribes and other backward caste (54.2%). Marital status was strongly associated with BMI; 63.9% married subjects were overweight/obese compared to 32.2% unmarried and without spouse subjects.

Overweight/obesity prevailed in 63.4% subjects having educational status as post-graduation and Ph.D., whereas, extent of underweight was 22.2% among illiterate + just literate subjects. Homemakers had the highest prevalence of overweight/obesity (72.7%) followed by subjects involved in business (61.9%) and service (57.1%) whereas, 45.5% skilled + labour and 46.2% unemployed subjects were overweight/obese. As much as 53.8% unemployed, 41.0% subjects involved in service and 40.0% skilled worker + labour were underweight.

Subjects from the upper socio-economic class were more (79.5%) overweight/obese and none of the subjects from this SES were underweight. In the upper-middle class, 59.7% subjects were overweight/obese, whereas, only 1.6% subjects were underweight. Among the lower-middle group, 52.2% subjects were overweight/obese and 4.3% subjects were underweight. Subjects from upper-lower and lower classes had more varied distribution, with 42.2% being overweight/obese and the highest proportion of underweight (8.9%) compared to other socio-economic groups. Overall, the distribution patterns postulate that higher socio-economic groups were more overweight/obese, whereas subjects from lower socio-economic classes more underweight or had normal BMI ($p<0.05$). Age religion, family type and size were not significantly associated with BMI. As much as 54.7%, 64.6% and 64.0% subjects aged 30-39, 40-49 and 50-59 years were overweight or obese, respectively. In all, 61.1% Hindu, 62.1% subjects from nuclear family and 63.7% subject with family size 2-4 were overweight and obese (Table 2).

Table 2: Linkage of body mass index of subjects with their sociodemographic variables.

Particulars	Normal		Underweight		Overweight and obese		Total		Test of Significance
	N	%	N	%	N	%	N	%	
Age (in years)									
30-39	90	42.1	7	3.3	117	54.7	214	100	χ^2=7.27 df=4; p=0.122
40-49	52	32..9	4	2.5	102	64.6	158	100	
50-59	58	35.4	1	0.6	105	64.0	164	100	
Gender									
Male	120	40.5	1	0.3	175	59.1	296	100	χ^2=12.708 df=2; p=0.002
Female	80	33.3	11	4.6	149	62.1	240	100	
Religion									
Hindu	191	36.6	12	2.3	319	61.1	522	100	χ^2=4.579 df=2 p=0.101
Muslim+ Christian	9	64.3	0	0.0	5	35.7	14	100	
Caste									
SC/ST	33	39.8	5	6.0	45	54.2	83	100	χ^2=11.88 df=4; p=0.019
OBC	64	42.4	4	2.6	83	54.2	151	100	
Other	103	34.1	3	1.0	196	64.9	302	100	
Marital status									
Unmarried + without spouse	34	57.6	6	10.2	19	32.2	59	100	χ^2=34.71 df=2; p=0.000
Married	166	34.8	6	1.3	305	63.9	477	100	
Education									
Illiterate+ just literate	4	22.2	4	22.2	10	55.6	18	100	χ^2=39.054 df=12 p=0.000
Primary	8	53.3	0	0.0	7	46.7	15	100	
Secondary	6	40.0	0	0.0	9	60.0	15	100	
High School	8	40.0	1	5.0	11	55.0	20	100	
Intermediate	14	34.1	1	2.4	26	63.4	41	100	
Graduation	63	40.9	2	1.3	89	57.8	154	100	
Post-graduation +Ph.D.	97	35.5	4	1.5	172	63.4	273	100	
Occupation									
Service	130	41.0	6	1.9	181	57.1	317	100	χ^2=25.052 df=8 p=0.002
Business	23	36.5	1	1.6	39	61.9	63	100	
Skilled worker +Labor	9	40.9	3	13.6	10	45.5	22	100	
Homemaker	31	25.6	2	1.7	88	72.7	121	100	
Unemployed	7	53.8	0	0.0	6	46.2	13	100	
Family type									
Nuclear	121	34.8	11	3.2	216	62.1	348	100	χ^2= 5.920 df=2; p= 0.052
Joint Family	79	42.0	1	0.5	108	57.4	188	100	
Family size									
≥5	81	42.2	6	3.1	105	54.7	192	100	χ^2=4.596 df=2; p=0.100
2-4	119	34.6	6	1.7	219	63.7	344	100	
Socio-economic status									
Upper	16	20.5	0	0.0	62	79.5	78	100	χ^2=28.027 df=6 p=0.000
Upper-middle	142	38.7	6	1.6	219	59.7	367	100	
Lower-middle	20	43.5	2	4.3	24	52.2	46	100	
Upper lower+ lower	22	48.9	4	8.9	19	42.2	45	100	

The linkage between BMI of subjects with their nutritional parameters is given in Table 3. BMI was significantly associated with waist circumference, waist hip ratio, muscle mass, visceral fat, body fat percentage, energy intake and level of physical activity. As much as 87.5% and 79.8% subjects classified as at risk based on waist circumference and waist-to-hip ratio were overweight/obese, respectively. Subjects with low muscle mass had a higher prevalence of overweight/obesity (72.8%) than subjects with normal (16.5%) and high + very high (15.8%) muscle mass. Visceral fat percentage was strongly related to BMI. None of the subjects with

very high visceral fat neither underweight nor had normal BMI; 100% and 74.9% subjects with very high and high visceral fat classified as overweight or obese, respectively. In all, 64.5% and 21.6% subjects with high and normal body fat percentage categorized as overweight or obese, respectively. As much as 50.0%, 65.2%, 60.3% subjects consuming <60%, 60.1-80% and >80% energy as per recommended daily allowance (RDA) were classified as overweight/obese, respectively. Of all, 61.0% sedentary, 56.6% moderate and 50.0% very active workers were overweight/obese.

Table 3: Linkage between body mass index and other nutritional parameters of subjects.

Nutritional parameters	Normal		Underweight		Overweight/obese		Total		Test of Sig.
	N	%	N	%	N	%	N	%	
Waist circumference									
Normal	166	64.6	11	4.3	80	31.1	257	100	χ^2=177.0
At risk	34	12.2	1	0.4	244	87.5	279	100	df=2; p=0.000
Waist-Hip ratio									
Normal	128	73.6	11	6.3	35	20.1	174	100	χ^2=179.248
At risk	72	19.9	1	0.3	289	79.8	362	100	df=2; p=0.000
Muscle mass									
Low	113	27.0	1	0.2	305	72.8	419	100	χ^2=239.28
Normal	66	83.5	0	0.0	13	16.5	79	100	df=4; p=0.000
High/very high	21	55.3	11	28.9	6	15.8	38	100	
Visceral fat %									
Normal	148	78.3	11	5.8	30	15.9	189	100	χ^2=266.34
High	52	24.6	1	0.5	158	74.9	211	100	df=4; p=0.000
Very high	0	0.0	0	0.0	136	100	136	100	
Body fat %									
Normal	29	56.9	11	21.6	11	21.6	51	100	χ^2=113.93
High	171	35.3	1	0.2	313	64.5	485	100	df=2; p=0.000
Energy intake									
<60% of RDA	0	0.0	1	50.0	1	50.0	2	100	χ^2=21.83
60.1-80% of RDA	8	34.8	0	0.0	15	65.2	23	100	df=4
>80% of RDA	192	37.6	11	2.2	308	60.3	511	100	p =0.000
Physical activity level									
Sedentary	176	36.7	11	2.3	292	61.0	479	100	χ^2=11.40
Moderate	23	43.4	0	0.0	30	56.6	53	100	df=4
Very active	1	25.0	1	25.0	2	50.0	4	100	p=0.022
Energy balance									
Positive	155	38.3	11	2.7	239	59.0	405	100	χ^2=2.66
Negative	45	34.4	1	0.8	85	64.9	131	100	df=2; p=0.265

DISCUSSION

In this study male subjects had a higher average waist circumference than female subjects and a higher waist hip ratio. Studies from Varanasi also reported the higher waist circumference in male.[6,7] ICMR-INDIAB study (phase I) also reported higher WC in male than female.[8] In this study females had greater mean hip circumference. This suggests relatively more central/truncal fat in men and more gluteofemoral (hip) fat accumulation in women. This finding widely recognized as gender-specific fat distribution (android versus gynoid). Such differences have important metabolic implications, because central obesity is more closely linked with cardio-metabolic risk than generalized obesity.[7,9] Globally, overweight and obesity have surged across diverse populations. The mean BMI of study subjects reflects that average study subjects were in the overweight category. This is consistent with a large-scale Indian study based on National Family Health Survey-5, which revealed high prevalence of overweight/obesity. In contrast to the finding of this study substantially lower average BMI has been reported in large, multi-region Indian study.[8] A cross-sectional study conducted on healthy adults in western Maharashtra suggests to look beyond BMI. The study comparing BMI and WHR revealed that WHR is a more effective anthropometric measure than BMI to predict visceral fat and related disease risk.[10] Therefore, present study with higher WHR in males and significant waist circumference in both genders likely to reflect a substantial burden of central adiposity, which may not be amply covered by BMI alone. The mean body fat and visceral fat percentage

observed in this study indicate relatively high adiposity among subjects. The elevated visceral fat is particularly relevant, as central adiposity is strongly associated with cardio-metabolic risk.

The BMI distribution of the study subjects reveals an important public-health concern. As much as 12 out of 25 and 13 out of 100 subjects were overweight and obese, respectively. Similar to present findings NFHS-5 (2021-2022) also reported high prevalence of overweight and obesity in adult subjects, especially in urban regions.[9] According to a large scale Indian study done in adults (age 20-54 year) covering data from 1999 to 2021 the proportion of adults classified as overweight/obese nationwide was (13 out of 50) much lower than in present study (3 out of 5).[11] A lower prevalence of overweight/obesity (23 out of 50) in adult subjects has been reported in nationally representative Indian research, highlighting that the burden of high BMI is increasing over time.[12] Study from United States revealed that (21 out of 50) of adults were obese which is lower than present study.[13] These parallels indicate that the rising burden of excess weight is a global phenomenon, cutting across socioeconomic and cultural boundaries.

The present study reveals a significant linkage between BMI and several socio-demographic variables, including gender, caste, marital status, education, occupation, and socioeconomic status. These findings underscore the multifactorial nature of overweight and obesity and highlighting that socio-demographic determinants play a critical role in shaping nutritional status and body composition. Both male (59 out of 100) and female (31 out of 50) in the present study had high prevalence of overweight/obesity. Female subjects were more overweight/obese. As per NFHS-5 (2019-21), nearly (19 out of 50) men and (41 out of 100) women were overweight/obese. Although prevalence of overweight/obese is lower than present study, it similarly highlights a higher proportion of overweight/obese females. Extent of overweight/obese was more in subjects belonging to the other caste category (13 out of 20), than SC/ST and OBC groups (27 out of 50). Married individuals (16 out 25) were significantly more overweight or obese than unmarried or widowed subjects (8 out 25). According to a systematic review the odds of obesity were 88% higher among married subjects compared with single/divorced and widowed subjects. Married subjects often experience lifestyle modifications reduced physical activity, increased caloric intake, and weight gain after marriage.[14]

Educational attainment found a significant linkage with overweight/obesity. Highest prevalence (63 out of 100) of obesity was observed in subjects with educational status intermediate, post-graduation and Ph.D. In consonance with this finding, a study from northeast India reported that overweight/obesity was more among adult subjects with higher education.[15] Subjects with higher education are more likely to be engaged in sedentary, desk-based occupations that involve prolonged sitting and minimal physical activity may leads to overweight/obesity. A study conducted among slum adult subjects in Mumbai reported a higher prevalence of obesity among subjects with primary, secondary and above education than illiterate, whereas overweight was more in the illiterate.[16] Homemakers had the highest overweight/obesity prevalence (73 out of 100) this trend documented in Indian settings due to reduced mobility, household confinement, and irregular eating patterns. A pan-Indian survey also revealed that 7 out of 10 homemakers had obesity.[17] Business workers (31 out 50) and service employees (57 out of 100) also reported high prevalence of overweight/obesity, reflecting occupational sedentary behaviour. Conversely, underweight was more in unemployed subjects and skilled laborers, likely due to higher physical activity and economic instability. Subjects from upper-class had highest overweight/obesity prevalence (nearly 4 out of 5), and none were underweight. A gradient was observed as SES decreased, underweight became more common, with the lower and upper-lower classes showing the highest underweight proportions (9 out of 100). These patterns are consistent with Indian perspective showing that rising incomes, urbanization, and lifestyle changes drive obesity among wealthier groups. Findings from nationally representative study reported higher wealth index linked to increased risk of both obesity and abdominal obesity.[12,18] Age, religion, family type, and family size were not significantly associated with BMI in this study. Although age is not statistically significant, overweight/obesity prevalence increased with advancing age from 11 out of 20 in those aged 30-39 to 16 out of 25 in those aged 50-59 years. A similar trend has been reported in a study based on a large analysis of the National Family Health Survey.[18] The lack of association with religion is may be due to obesity trends are more strongly driven by SES and lifestyle factors rather than religious background.

The present study identifies a strong and statistically significant relationship between BMI and multiple nutritional and lifestyle parameters, including waist circumference, waist-to-hip ratio (WHR), muscle mass, visceral fat, body fat percentage, dietary energy intake, and physical activity levels. These linkages emphasize the multifactorial aetiology of overweight and obesity, underlining the interplay between physiological attributes and behavioral patterns in determining body mass index of adult subjects. A substantial proportion of subjects categorized as at risk based on waist circumference (nearly 22 out of 25) and WHR (4 out of 5) were overweight or obese. This highlights that the central obesity is closely linked to elevated BMI. Similar finding has been reported in a study done in urban area of Meerut.[19] Low muscle mass was significantly linked to overweight/obesity in this study. Nearly 8 out of 11 were overweight/obese with low muscle mass. This relationship supports the evolving concept of sarcopenic obesity, where excess fat accumulation co-occurs with reduced muscle mass.[20] Low muscle mass probably disrupts metabolic homeostasis and increases insulin

resistance, promoting weight gain and adiposity. The study demonstrated a strong association between visceral fat and BMI, All subjects had very high' visceral fat and (3 out of 4) of those with high visceral were overweight or obese. A study from Gujarat also revealed that subjects with BMI≥25 kg/m^2 had higher total fat mass and visceral fat levels.[21] High body fat percentage had significant association overweight/obese subjects had high body fat percent; 16 out of 25 overweight/obese subjects had high body fat percent. Consistent with this, a tertiary-care hospital study from New Delhi also reported moderate positive correlation between BMI and body fat percentage.[22] Across different energy intake categories (<60%, 60-80%, and >80% of RDA), a high proportion (3 out of 5 to 13 out of 20) of subjects were overweight/obese, indicating that excessive caloric intake is not the only factor contributing to obesity. Physical activity showed an inverse relationship with BMI; nearly 3 out of 5 sedentary workers were overweight/obese, compared with nearly 8 out of 14) in the moderately active and 1 out of 2 in very active subjects. Physical inactivity is a well-established risk factor for obesity in India and globally. Indian research revealed that sedentary occupations and limited leisure-time activity significantly increase obesity risk in urban adults.[12] The cross-sectional design of the study limits the establishment of causal relationships between anthropometric indicators and body mass index (BMI). Potential confounding factors viz., genetic predisposition, hormonal disorders, medication use and psychological stress were not assessed, which may have influenced the BMI status of subjects. Despite these limitations, the study provides useful insights into the anthropometric determinants of BMI among urban adults.

CONCLUSION

The study highlights that overweight and obesity result from a complex interplay of body composition parameters, diet, and physical activity. Indicators such as visceral fat, waist circumference, WHR, and body fat percentage were associates of overweight/obesity than energy intake alone. Findings emphasize the need for comprehensive obesity assessment using multiple anthropometric and lifestyle indicators rather than relying solely on BMI. The high proportion of overweight and obese subjects in this study underscores a shift toward nutritional excess, consistent with the nutrition transition. Tailored efforts at state levels are required to further strengthen existing policies and develop new interventions to target both forms of malnutrition.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Yadav AR, Keshari P. Anthropometric indicators and determinants of body mass index of urban adult subjects: insights from community-based study. Int J Community Med Public Health 2026;13:3489-96.