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A community based cross-sectional study on prevalence of overweight and obesity among adult population of Jabalpur City, Madhya Pradesh, India

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Abstract---Introduction: The WHO had estimated that in 2016, more than 1.9 billion adults worldwide (39%) were overweight, and over 650 million (13%) were obese. Approximately 2.8 million deaths were reported as a result of being overweight or obese. The prevalence of overweight and obesity in India is increasing faster than the world average. A study reported that prevalence of obesity in India is 40.3%. This fast-paced growth has been accompanied by notable increases in the burden of non-communicable diseases. Objectives: to estimate the prevalence of overweight and obesity among adults in Jabalpur City and to study the association between socio-demographic factors and overweight in adults. Methodology: Multistage sampling method was used for the study. In this method, the sampling procedure was carried out at several stages, each stage involves a different sampling procedure. House to house survey was conducted after explaining the purpose and procedure of the study and obtaining informed written consent from study participants. Interview of eligible study participants regarding socio-demographic,

behavioral parameters along with measurement of physical/ anthropometric parameters was carried out using a predesigned and pretested Questionnaire. Results: We included a total of 482 adults based on inclusion and exclusion criteria. The results of our study show the prevalence of obesity of 8.7% and overweight 33.6%. We also studied prevalence of abdominal obesity in adults based on waist circumference. Out of 482, 273 (56.6%) adult had abdominal obesity, it's prevalence was higher in females 200 (77.8%) than males 73 (32.4). Discussion and Conclusion: Prevalence of overweight & Obesity was found high in the Jabalpur city. Similarly other authors also reported high prevalence of obesity. In the present study it is more prevalent among aging urban men than women. Caste, marital status, education and occupation of study participants were found to be associated factors.

Keywords---obesity, overweight, community, non-communicable diseases, prevalence, adult.

Introduction

Obesity is one of the major public health problems affecting every region of the globe. It is characterized with an increase in the size and amount of fat cells in the body. It is a chronic disorder that is officially classified as a disease by the World Health Organization (WHO), and also by several other national and international organizations.¹ The definition of the term by the Obesity Medicine Association captures both its complex etiology and diverse consequences: “a chronic, relapsing, multi-factorial, neurobehavioral disease, wherein an increase in body fat promotes adipose tissue dysfunction and abnormal fat mass physical forces, resulting in adverse metabolic, biomechanical and psychosocial health consequences.”²

Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m²). 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.¹ The WHO had estimated that in 2016, more than 1.9 billion adults worldwide (39%) were overweight, and over 650 million (13%) were obese. Approximately 2.8 million deaths are reported as a result of being overweight or obese.¹ Furthermore, researchers from the NCD Risk Factor Collaboration reported that the obesity prevalence increased in every country between 1975 and 2016; the greatest increases were noted in South Asia, Southeast Asia, the Caribbean, and Southern Latin America.³

A study reported that prevalence of obesity in India is 40.3%. Zonal variations were also observed as follows: south highest at 46.51% and east lowest at 32.96%. Obesity was higher among women than men (41.88% vs. 38.67%), urban than rural (44.17% vs. 36.08%).⁴ The prevalence of overweight and obesity in India is increasing faster than the world average. This fast-paced growth has been accompanied by notable increases in the burden of non-communicable diseases

(NCDs).⁵ Patients with obesity are at major risk for developing a range of comorbid conditions, including cardiovascular disease (CVD), gastrointestinal disorders, type 2 diabetes (T2D), joint and muscular disorders, respiratory problems, psychological issues and certain cancers which may significantly affect their daily lives as well as increasing mortality risks. ⁶ There is an immediate need to address the burden of obesity, the greatest risk factor contributing to non-communicable diseases. Hence the present study was conducted to estimate the prevalence of overweight and obesity among adult population in Jabalpur City and their association with Sociodemographic factors.

Objectives of the Study

- a. To estimate the prevalence of overweight and obesity among adults in Jabalpur City.
- b. To study associated socio-demographic factors.

Materials and Methods

Study Setting: This study was conducted in 30 wards of the Jabalpur City Municipal Corporation, MP.

Study design: We conducted a cross-sectional study.

Study Period: from February 2020 to January 2021.

Study population: Adults residing in Jabalpur City, MP.

Sample size: Sample size was determined by formula for Sample size determination for proportion as follows:

$$N = \frac{z^2 pq}{l^2}$$

Where

- N= sample size,
- Z= 1.96 (for 95% CI)
- p= prevalence of overweight
- q= 100- p
- l= allowable error (15% of prevalence)

For estimation of sample size we considered prevalence of overweight 30% as reported by Marie Ng et al (2014).⁷ The calculated sample size was 415. Adding 15% non responders to the above, a total sample of 482 was finalized for this study.

Inclusion criteria

1. Adults in the age group of 20-50 years
2. Those who are willing to participate in the study
3. Persons of both gender
4. Permanent residents of Jabalpur city (Those who have valid address proof either Aadhar or Voter ID)

Exclusion criteria: we excluded the following subjects with

1. Severely ill persons
2. Mentally ill persons
3. Pregnant women

Sampling Method and Selection of the Study Participants

- Multistage sampling method was used for the study. In this method, the sampling procedure was carried out at several stages, each stage involves a different sampling procedure.
- Jabalpur city of Madhya Pradesh has 79 wards. Out of 79 wards, 30 wards were selected by simple random method (lottery method). The number of the houses for the study in each ward was determined according to Population Proportion to Size. From each ward, houses were selected for study by systematic random sampling method using n^{th} interval. The first house in each ward was determined by a random number generated in excel. The numbers of adults in each ward for the study were determined according to the proportion. One eligible individual from each household was selected randomly for the study. When the selected household does not respond for the study, then house next to it was selected for the study.

Data Collection

- House to house survey: It was conducted after explaining the purpose and procedure of the study and informed written consent was also obtained from all study participants. Interview of eligible study participants regarding socio-demographic, behavioral parameters along with measurement of physical parameters (height, weight & waist circumference) was carried out using a predesigned & pretested interview schedule. The body mass index (BMI) was calculated using the formula weight in kg/height in metre², and waist circumference was measured using measuring tape.

Following criteria was used for classification of overweight and Obesity:

- UNDERWEIGHT- BMI <18.5 kg/m²
- NORMAL WEIGHT- 18.5 to <25 kg/m²
- OVERWEIGHT - BMI ≥ 25 kg/m²
- OBESITY - BMI ≥ 30 kg/m²
- ABDOMINAL OBESITY- Waist circumference (WC) cut-offs for diagnosis of abdominal obesity in males and females

Was 90 cm and 80 cm, respectively.

Statistical analysis

Data was coded and compiled using Microsoft excels software and analyzed using IBM SPSS software version 23. Categorical data was expressed in numbers and percentage while numerical data was represented as mean and Standard deviation and a p value of <0.05 was considered statistically significant. The

association between socio-demographic factors with overweight was determined using chi-square test.

Results

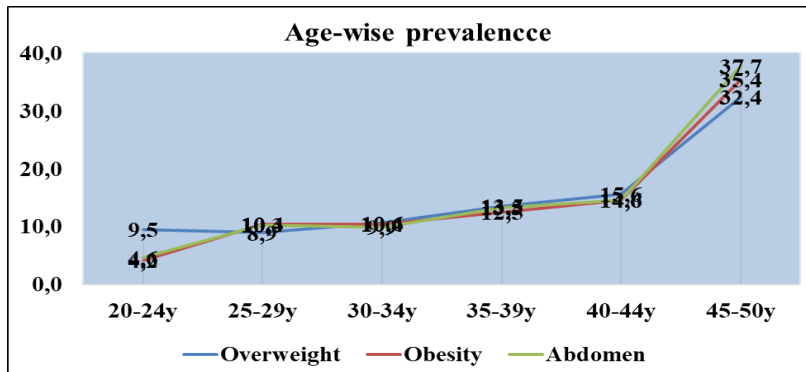
| Body Mass Index (BMI) | Male | Female | Total (n=482) |
|--|-------------|--------------|---------------|
| | n (%) | n (%) | n (%) |
| Underweight | 10 (4.4) | 38 (14.8) | 48 (9.9) |
| Normal | 116 (51.5) | 114 (44.3) | 230 (47.7) |
| Overweight | 87 (38.6) | 75 (29.2) | 162 (33.6) |
| Obesity | 12 (5.3) | 30 (11.6) | 42 (8.7) |
| Total | 225 (100) | 257 (100) | 482 (100) |
| Mean BMI (kg/m ²) + standard deviation | 24.26 ± 4.0 | 24.13 ± 4.66 | 24.19 ± 4.363 |

Table:1 shows the pattern of body mass index in study subjects. Out of 482, 42 (8.7%) adults, 30 (11.6%) females and 12 (5.3%) males were obese whereas 162 (33.6%) adults were overweight, Proportion of overweight was higher in 87 (38.6%) males than 75 (29.2%) females, however, 230 (47.7%) adults were normal and only 48 (9.9%) were underweight. Mean BMI in adults was 24.19 kg/m² with ± 4.363 standard deviation, in males was 24.26 kg/m² and in females was 24.13 kg/m². Hence mean BMI was within the normal range.

| Waist circumference | Male | Female | Total N=482 |
|--|--------------|--------------|---------------|
| | n (%) | n (%) | n (%) |
| Abdominal obesity(WC- Men >90cms, female >80cms) | 73 (32.4) | 200 (77.8) | 273 (56.6) |
| No abdominal obesity | 152 (67.6) | 57 (22.2) | 209 (43.4) |
| Total | 225 (100) | 257 (100) | 482 (100) |
| Mean Waist circumference (cm) + standard deviation | 87.24 ± 6.52 | 85.54 ± 6.61 | 86.33 ± 6.619 |

Table:2 shows the magnitude of abdominal obesity among adults based on waist circumference. Out of 482, 273 (56.6%) study participants had abdominal obesity, it was more prevalent in females 200 (77.8%) than males 73 (32.4) whereas 209 (43.4%) study participants do not have abdominal obesity. Mean waist circumference was 86.33 cm with ± 6.619 standard deviation, in males was 87.24 cm and in females was 85.54 cm.

Graph-1: Age-wise prevalence of Overweight, Obesity, and Abdominal circumference



According to graph-1, the prevalence of overweight, obesity, and abdominal obesity was increasing with age and it was highest in the age group of 45-50 years.

| | | Overweight | | Total (N=482) | P-value |
|----------------|----------------------------|--------------|-------------|---------------|---------|
| | | Present n(%) | Absent n(%) | | |
| Gender | Male | 99 (44) | 126 (56) | 225 (46.7) | 0.486* |
| | Female | 105 (40.9) | 152 (59.1) | 257 (53.3) | |
| Total | | 204 (42.3) | 278 (57.7) | 482 (100) | |
| Religion | Hindu | 180 (40.9) | 260 (59.1) | 440 (100) | 0.069** |
| | Muslim | 8 (53.3) | 7 (46.7) | 15 (100) | |
| | Christian | 10 (50.0) | 10 (50.0) | 20 (100) | |
| | Others (Sikh and Jain) | 6 (85.7) | 1 (14.3) | 7 (100) | |
| Total | | 204 (42.3) | 278 (57.7) | 482 (100) | |
| Caste | General | 85 (53.5) | 74 (46.5) | 159 (100) | 0.003* |
| | Other Backward Class (OBC) | 75 (34.4) | 143 (65.6) | 218 (100) | |
| | Schedule caste (SC) | 29 (39.7) | 44 (60.3) | 73 (100) | |
| | Schedule tribe (ST) | 15 (46.9) | 17 (53.1) | 32 (100) | |
| Total | | 204 (42.3) | 278 (57.7) | 482 (100) | |
| Type of family | Nuclear | 150 (41.8) | 209 (58.2) | 359 (100) | 0.681* |

| | | | | | |
|-----------------------|-------------------------|------------|---------------|--------------|---------|
| | Joint | 54 (43.9) | 69 (56.1) | 123 (100) | |
| Total | | 204 (42.3) | 278 (57.7) | 482 (100) | |
| Marital status | Married | 150 (44.4) | 188 (55.6) | 338 (100) | 0.049** |
| | Unmarried | 35 (35.4) | 73 (67.6) | 108 (100) | |
| | Divorced | 3 (75) | 1 (25) | 4 (100) | |
| | Widowed | 16 (50) | 16 (50) | 32 (100) | |
| Total | | 204 (42.3) | 278 (57.7) | 482 (100) | |
| Education | Illiterate | 11 (40.7) | 16 (59.3) | 27 (100) | 0.016* |
| | Literate | 5 (41.7) | 7 (58.3) | 12 (100) | |
| | Primary school | 13 (30.2) | 30 (69.8) | 43 (100) | |
| | Middle school | 30 (35.3) | 55 (64.7) | 85 (100) | |
| | High school | 26 (40) | 39 (60) | 65 (100) | |
| | Higher secondary school | 28 (35) | 52 (65) | 80 (100) | |
| | Graduation | 61 (50) | 61 (50) | 122 (100) | |
| Total | | 204 (42.3) | 278 (57.7) | 482 (100) | |
| Occupation | Professional | 19 (46.3) | 22 (53.7) | 41 (100) | 0.014* |
| | Semi-professional | 34 (66.7) | 17 (33.3) | 51 (100) | |
| | Arithmetic skill worker | 18 (47.4) | 20 (52.6) | 38 (100) | |
| | Skilled worker | 26 (38.8) | 41 (61.2) | 67 (100) | |
| | Semi-skilled worker | 18 (30.5) | 41 (69.5) | 59 (100) | |
| | Unskilled worker | 14 (38.9) | 22 (61.1) | 36 (100) | |
| | Unemployed | 9 (42.9) | 12 (57.1) | 21 (100) | |
| | Others*** | 66 (39.1) | 103 (60.9) | 169 (100) | |
| Total | | 204 (42.3) | 278 (57.7) | 482 (100) | |
| Socio-economic status | Upper (I) | 26 (54.2) | 22 (45.8) | 48 (100) | 0.096** |
| | Upper-middle (II) | 124 (44.8) | 153 (55.2) | 277 (100) | |
| | Lower-middle (III) | 39 (35.1) | 72 (64.9) | 111 (100) | |
| | Upper-Lower (IV) | 13 (31.7) | 28 (68.3) | 41 (100) | |
| | Lower (V) | 2 (40) | 3 (60) | 5 (100) | |
| Total | | 204 (42.3) | 278 (57.7) | 482 (100) | |

Table:3 depicts the association between overweight (BMI > 25 Kg/M²) and socio-demographic factors in adults. Overweight was more common in males 99 (44%) than females 105 (40.9%). High frequency of overweight was seen in Others

(Sikhs & Jains) 6 (85.7%) followed by in Muslims 8 (53.3%) and Christians 10 (50%). Prevalence was slightly higher among adult from joint family 54 (43.9%) than those in nuclear family 150 (41.8%). High frequency of overweight was observed in upper class 26 (54.2%) followed by in upper middle class 124 (44.8%) whereas most of those in upper lower class 28 (68.3%) had normal weight. But gender, religion, type of family, and socio-economic status were not significantly associated with overweight and obesity (P-value > 0.05). Overweight was mostly seen in general caste 85 (53.5%) followed by in ST 15 (46.9%) while most of those in OBC 143 (65.6%) had normal weight, this association was found to be highly statistical significant (P-value 0.003). Adults who were divorced 3 (75%) had overweight followed by those who were married 150 (44.4%), whereas most of unmarried 73 (67.6%) had normal weight. 30 (62.5%) Postgraduates had overweight followed by graduates 61 (50%) whereas most of those who completed primary school 30 (69.8%) had normal weight. Overweight was mostly seen in semi-professionals 34 (66.7%) followed by arithmetic skill workers 18 (47.4%). Marital status, education and occupation were significantly associated with overweight (P-value < 0.05).

Discussion

The present cross-sectional community based study was conducted in adult population of Jabalpur city. Total 482 adult participants were included in the study based on inclusion and exclusion criteria. The results of our study show the prevalence of obesity of 8.7% and overweight 33.6%. We also estimated the prevalence of abdominal obesity in adults based on waist circumference. Abdominal /Visceral obesity is more important than subcutaneous form. Out of 482, 273 (56.6%) adult participants had abdominal obesity, it was higher in females 200 (77.8%) than males 73 (32.4).

A study by PS Sharma et al.⁸ in 2017 at Kerala, found the prevalence of Overweight was 33.5%, which was consistent with the present study. Supa Pengpid and Karl Peltzer⁹ at Kenya in 2015 and Girdhar S et al.¹⁰ at Ludhiana in 2013 found that the prevalence of overweight was 18.9% and 12.7% respectively which was less than the present study. However Supa Pengpid and Karl Peltzer⁹ at Kenya found the prevalence of obesity was 9.1% which was nearly similar with present study but Girdhar S et al.¹⁰ noted higher prevalence of obesity as compared to present study (29.6% Vs 8.7%). While another study by Bhavin N Vadera et al.¹¹ at Gujarat in 2008 found the prevalence of overweight & obesity less than the present study which was 22.04% & 5.2% respectively. Less physical activity, high consumption of foods rich in sugars and fats could result in high prevalence of overweight and obesity.

In the present study we also estimated the prevalence of abdominal obesity in adults based on waist circumference. Abdominal /Visceral obesity is more important than subcutaneous form. Out of 482, 273 (56.6%) adult participants had abdominal obesity, it was higher in females 200 (77.8%) than males 73 (32.4). Other Studies by Vamsi Krishna Undavalli, Satyanarayana Chowdary Ponnaganti and Hanumanth Narni¹² at Andhra Pradesh and Sarma P S et al.⁸ at Kerala found that the prevalence of abdominal obesity was 71.2% and 67.4% which was high in comparison with present study, they also found that

prevalence of abdominal obesity was higher in females than males these findings were in correspondence with present study. This variation could be due to changes in dietary habits, physical activity and life style.

We studied the association between overweight (BMI > 25 Kg/M²) and socio-demographic factors in adults. Overweight was more prevalent in males than females (44% Vs 40.9%), among participants from Sikhs & Jains religion (85.7%) & from joint family than those in nuclear family (43.9% Vs 41.8%). High frequency of overweight was observed in upper class (54.2%) followed by in upper middle class (44.8%) whereas most of those in upper lower class (68.3%) had normal weight. But gender, religion, type of family, and socio-economic status of study participants were not significantly associated with overweight (P-value > 0.05).

Overweight was mostly seen in general caste (53.5%) followed by in ST (46.9%) while most of those in OBC 143 (65.6%) had normal weight, this association was found to be highly statistical significant (P-value 0.003). Adults who were divorced 3 (75%) had overweight followed by those who were married 150 (44.4%), whereas most of unmarried 73 (67.6%) had normal weight. Postgraduates 30 (62.5%) had overweight followed by graduates 61 (50%) whereas most of those who completed primary school 30 (69.8%) had normal weight. Overweight was mostly seen in semi-professionals (66.7%) followed by arithmetic skill workers 18 (47.4%). Marital status, education and occupation were significantly associated with overweight (P-value < 0.05).

J S Thakur et al.¹³ at Punjab found that overweight increased with increase in education and Mohammed Khaled Al-Hanawi and Mpho Keetile¹⁴ at Saudi reported that overweight was high in married, unemployed or homemakers it could be due to with increase in education more obvious to do sedentary work and no proper time for physical activity resulting in weight gain and overweight. Lunar S et al.¹⁵ found that overweight increased with increase in socio-economic status which was in correspondence with present study, it could be due to that high income gives purchasing power, changes in dietary pattern, consumption of food high in salt, sugar and fats and less physical activity resulting in overweight. The evidence from a national cross-sectional community survey in Kenya in 2015, done by Supa Pengpid and Karl Peltzer⁹, found that the prevalence of overweight was 18.9% and obesity was 9.1%. This high prevalence of overweight or obesity was significantly associated with middle and older age, female gender, higher education, greater wealth, urban residence, no current tobacco use, low physical activity, and having hypertension.

A Cross-Sectional Study done by Girdhar S et al.¹⁰ at Ludhiana in 2013, found that the prevalence of overweight and obesity was significantly higher in married housewives of high socio-economic status. A Cross-sectional study done by Rui Wang et al.¹⁶ in China in 2012, found the overall prevalence of overweight was 32.3% (male 34.3% and female 30.2%) and Obesity was 14.6% (male 16.3% and female 12.8%). The prevalence of both overweight and obesity was significantly high in men than women (p<0.05), increase in age, married people, sedentary occupation, smoking, drinking alcohol, more meat consumption, and fewer hours of sleep (p<0.05).

Conclusion

Prevalence of overweight & Obesity was found high in the Jabalpur city. It is more prevalent among aging urban men than women who are college educated. Prevalence of Central obesity was very high among females as compared to males. Caste, Marital status, Education and occupation of study participants were found to be associated factors. Hence there is an urgent need to educate and counsel people of Jabalpur city to adopt healthy lifestyle practices.

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