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Research Article

Prevalence of Obesity and Association of Diabetes Mellitus among Adults Aged between 30 to 60 Years Residing in Rural Area - A Cross Sectional Study

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I N F O

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A B S T R A C T

Introduction: India is a developing country which is seeing a transition from communicable diseases to non-communicable disease. Even as India battles malnutrition, the country has developed another nutritional problem obesity. In past 10 years, the number of obese people has doubled in our country and more than 135 million individuals were affected by obesity.

Objectives: To know the prevalence of obesity among adults aged between 30 to 60 years residing in rural area and to assess association of Diabetes Mellitus among them.

Materials and Methods: This community based cross-sectional study was carried out Agasga, the rural field practice area of Department of Community Medicine, among 855 adults aged between 30-60 years by using a predesigned & pretested schedule. Statistical analysis was done using percentages and Chi-square test.

Results: The overall prevalence of overweight and obesity were 38.2% and 10.3% respectively according to Asian criteria of obesity and 35.2% and 0.9% respectively by WHO criteria of obesity classification. Significant association was found with BMI and diabetes.

Conclusion: Even though WHO criteria helps us finding overweight and obese people, Asian criteria will be more beneficial in identifying at risk people.

Implications: Asian criteria of classification of obesity has to be implicated to identify and prevent complications of obesity.

Keywords: Asian/ WHO Criteria, BMI, Diabetes Mellitus, Obesity

Introduction

India is a developing country which is seeing a transition from communicable diseases to non-communicable disease. Even as India battles malnutrition, the country has

developed another nutritional problem - obesity. Obesity defined by the World Health Organization, as a Body Mass Index (BMI) ≥30 kg/m^2 is gradually assuming an epidemic dimension Worldwide obesity has nearly tripled since 1975. In 2016, over 650 million were obese and more than 1.9 billion adults were overweight.[1] Of late most people are dying of overweight and its sequel than that due to underweight. In past 10 years, the number of obese people has doubled in the country, according to the National Family Health Survey (NFHS-4).[2] In India, more than 135 million individuals were affected by obesity.

Obesity has been shown to be a predisposing factor in the rising prevalence of morbidity and mortality associated with non-communicable diseases like type-2 diabetes mellitus, hypertension, cancer, stroke among adults. Experts believe that obesity is the major reason for developing different types of diabetes mellitus. Several researchers have highlighted that obesity accounts for 80-85 per cent of the risk of developing type-2 diabetes.

Earlier obesity was confined to urban areas due to easy accessibility of all amnesties and life style changes incorporate among the public. But of late obesity is fast spreading to other part of country i.e. rural and semi urban areas also. This transitional change might lead to consequences of obesity complications like diabetes, high blood pressure, cancer and stroke. The problem might be harder to deal with than in urban areas, which generally have easy accessibility and better healthcare services.

Objectives

The objectives of the study were:

- To know the prevalence of obesity among adults aged between 30 to 60 years residing in rural area.
- To assess association of Diabetes Mellitus among them.

Materials and Methods

A cross section study was conducted between period 1st January, 2015 to 31st March, 2015 at Agasga village of Primary Health Center (PHC), Handignur which is a rural field practice area of Department of Community Medicine, Jawaharlal Nehru Medical College, Belgaum. The total population of Agasga village is around 4000. As per voter's list the number of adults aged between 30-60 years residing in this area are approximately1900. Sampling frame was prepared, taking obesity as 26%[3], 855 participants were identified and included in the study.

Inclusion

- Adults aged between 30-60 years.
- Residents of Agasga village for ≥ one year.

Ethical Clearance

The study was approved from Institutional Ethics Committee for Human Subject's Research, Jawaharlal Nehru Medical College, Belgaum.

Data Collection Procedure

A study proforma was developed, based on the socio-demographic profile, eating habits and present health status and physical activity. Eating habits were enquired by asking the dietary profile of the participants regarding the vegetarian or mixed diet and also for fast and fried food diet. Mixed diet included both vegetarian and non-vegetarian diet. The proforma was pre-tested and necessary corrections were made accordingly.

Height: The subject was asked to stand straight without footwear, with heels, buttocks and back straight and arms hanging by side. The height was measured from head to heal. The co-inciding reading was measured to the nearest 0.1 cm using a metallic measuring tape.[4]

Weight: Body weight was measured without any foot wear and with minimal clothing to the nearest 0.1 kilogram using a standard portable adult weighing machine, which was standardized periodically during the study. The scale was adjusted to zero before each session and weight was recorded in kilograms.[4]

Calculation of Body Mass Index (BMI in Kg/m^2): Body mass index was calculated as:

$$\text{BMI} = \frac{\text{Weight in Kg}}{(\text{Height in Meter})^2}$$

Based on WHO and International Obesity Task Force (IOTF) BMI cut-off standards for Asia and India, obesity was defined as below.[5]

Table 1

Category	BMI range (Kg/m^2)
Underweight	<18.5
Normal	18.5-22.99
Overweight	23-25
Obesity	>25

As per the revised guidelines recommended by WHO, persons with BMI values of less than 18.5 were classified as "Underweight", 18.5 to 24.99 were classified as "Normal weight", 25.0 to 29.99 were classified as "overweight/ pre-obese" and 30.0 to 34.99 were classified as "Obese class I", 35.0 to 39.99 were classified as "Obese class II", ≥40.0 were classified as "Obese class III".[6]

Waist circumference (WC): The measurement was made at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest and the subject stands with arms at the sides, feet positioned

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close together, and weight evenly distributed across the feet.[7] Waist circumference >80 centimeter for females and >90 centimeter for males was considered to have abdominal obesity.[8]

Hip Circumference (HC): It is the maximum circumference in the horizontal plane measured over the buttocks at the level of greater tubercle.[4]

Waist hip ratio (WHR): The ratio of waist circumference to the hip circumference less than 0.85 in females and less than 1.0 in male was considered normal.[9]

Table 2

Category	BMI range (Kg/m²)
Underweight	<18.5
Normal	18.5 - 24.99
Overweight	25 - 29.99
Obesity class I Obesity class II Obesity class III	30 - 34.99 35 - 39.99 ≥40.0

Result

In present study Out of 855 study participants, 415 (48.53%) were male and 440 (51.54%) were female participants. 150 (17.54%) participants were between age group of 30-34 years, 425 (49.7%) between 35 to 49 years, 280 (32.74%) between 50 to 60 years. In the study, 683 (79.8%) of the participants were heavy workers, 144 (16.5%) were moderate workers 28 (3.27%) were sedentary workers.

Overweight and Obesity

Table 3.Distribution of the study participants according to body mass index - Asian criteria (kg/m²) (N=855)

BMI categories (kg/m²)	Men (%)	Women (%)	Total (%)
Underweight (<18.5)	3 (0.7)	12 (2.7)	15 (1.8)
Normal (18.5-22.9)	208 (50.1)	211 (48)	419 (49)
Overweight (23.0-24.9)	157 (37.8)	176 (40)	333 (38.9)
Obese (≥25.0)	47 (11.3)	41 (9.3)	88 (10.3)
Total	415 (100)	440 (100)	855 (100)
χ^2=6.189; Df=3; P=0.103			

In the present study, underweight was more among women. The overall prevalence of overweight and obesity were 38.2% and 10.3 % respectively. The prevalence of overweight was more among women compared to men (40% vs. 37.8%); whereas among obese, men were more compared to women (11.3 vs. 9.3). The difference was not statistically significant (P=0.103).

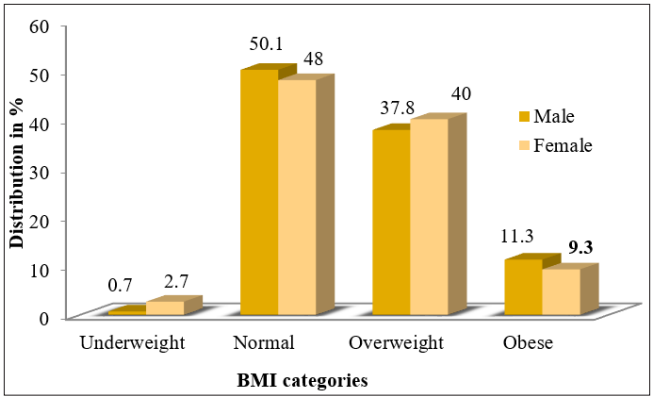

Figure 1.Distribution of the study participants according to Asian BMI categories

Table 4.Distribution of the study participants according to body mass index (kg/m²) (N=855) according to WHO criteria

BMI categories (Kg/m²)	Men (%)	Women (%)	Total (%)
Underweight (<18.5)	3 (0.7)	12 (2.7)	15 (1.8)
Normal (18.5-24.9)	255 (61.4)	277 (63.4)	532 (62.4)
Overweight (25.0-29.9)	155 (37.3)	145 (33.2)	300 (35.2)
Obese (≥30.0)	02 (0.5)	06 (1.4)	08 (0.9)
Total	415 (100)	440 (100)	855 (100)
χ^2=6.17; Df=3; p=0.048			

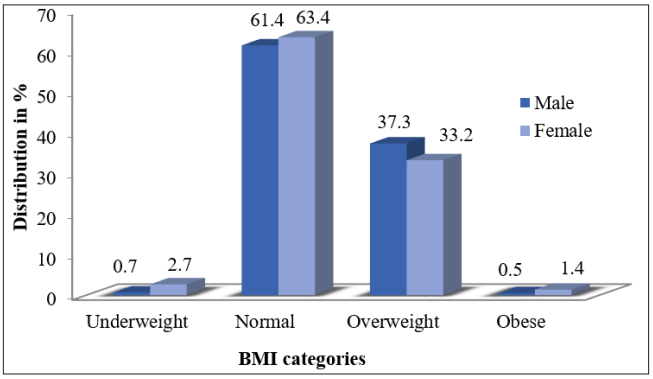

Figure 2.Distribution of the study participants according to WHO BMI categories

In the present study more women were underweighted while compared to men and the overall prevalence of overweight and obesity were 35.2% and 0.9% respectively. The prevalence of overweight was more among men

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compared to women (37.3% vs. 33.2%); whereas among obese, women were more. The difference was statistically significant (p=0.048).

Table 5.Distribution of the study participants according to waist circumference (WC) (N = 855)

WC categories (in cms)	Men (%)	Women (%)	Total (%)
Normal M<90, F<80	215 (51.8)	76 (17.3)	291 (34)
Abnormal -1 M ≥90-99 F ≥80-89	183 (44.1)	228 (51.6)	411 (48)
Abnormal -2 M ≥100 F ≥90	17 (4.1)	136 (30.9)	153 (17.9)
Total	415 (100)	440 (100)	855 (100)
χ^2 = 163.286; Df = 2; p <0.001			
WHR categories	**Men (%)**	**Women (%)**	**Total (%)**
Normal M<1 F <0.85	414 (99.8)	95 (21.6)	509 (59.3)
Abnormal M>1 F > 0.85	1 (0.2)	345 (78.4)	346 (40.46)
Total	415 (100)	440 (100)	855 (100)
χ^2 = 541.662; Df = 1; P <0.001			

In the present study, the overall prevalence of abdominal obesity based on waist circumference was 65.9%. The prevalence among women was significantly high than that of men (82.4.0% vs. 48.0%). The difference was statistically significant (P<0.001).

In the present study, the overall prevalence of abdominal obesity based on waist:hip ratio criteria were 40.46%. The prevalence among women was significantly high than that of men (78.0% vs. 0.2%). The difference was statistically significant (P<0.001).

Table 6.Association of BMI (Asian criteria and WHO criteria) with subjects diagnosed with diabetes mellitus

BMI (Asian criteria)	Diabetes mellitus present (%)	Diabetes mellitus absent (%)	Total (%)
Underweight + Normal weight	15 (3.5)	419 (96.54)	434 (50.76)
Overweight + Obese	66 (15.7)	355 (84.32)	421 (49.23)
Total	81 (9.47)	774 (90.52)	855 (100)
χ^2=37.214; Df=2; P<0.001			

BMI (WHO Criteria)	Diabetes mellitus present (%)	Diabetes mellitus absent (%)	Total (%)
Underweight + Normal weight	27 (4.9)	520 (95.06)	547 (63.97)
Overweight + Obese	54 (17.5)	254 (82.46)	308 (36.02)
Total	81 (9.47)	774 (90.52)	855 (100)
χ^2=36.456; Df=2; P<0.001			

In this present study, among subjects diagnosed with Diabetes, 3.5% were under weight and normal category. 15.7% were under overweight and obese category. Significant association was found with BMI. More Diabetic patients were found to be in overweight and obese category (p <0.001).

In the present study the prevalence of Diabetes, assessed by checking FBS, we found 81 (9.5%) were having diabetes; 92 (10.8%) were at risk of getting Diabetes Mellitus.

In this present study, among subjects diagnosed with Diabetes, 4.9% were under weight and normal category. 17.5 % were under overweight and obese category. Significant association was found with BMI and Diabetes Mellitus (p<0.001).

Discussion

The present cross-sectional study was conducted at Agasga - a village under Primary Health Center, Handignur which is a rural field practice area of Department of Community Medicine, Jawaharlal Nehru Medical College, Belgaum, during the period January 2015 to March 2015.

This study was conducted to estimate the prevalence of obesity (generalized and abdominal) among rural residents using Asian criteria of BMI and WHO criteria of BMI. In the study age standardized prevalence of generalized obesity as per Asian criteria for BMI, the overall prevalence of overweight and obesity were 38.9% and 10.3% respectively. While using WHO criteria for BMI prevalence of overweight and obesity were 35.2% and 0.9% respectively.

According to study conducted among Chennai urban population showed the overall age-standardized prevalence of obesity using the Asian criteria for BMI, it was 26.5%; while using WHO criteria for BMI it was 4.0%.[10] The Chinese National Nutrition Survey showed that the prevalence of obesity (BMI≥25) was 17.2% in Shanghai, 26.5% in Tianjin and 32.8% in Beijing. Using (BMI≥30), the prevalence of obesity (BMI≥30) among Hong Kong Chinese population was 2.2% in men and 4.8% in women[11] (Table 3 and 4).

The overall prevalence of moderate and high central obesity assessed by WC using Asia Pacific definition was 48% and 17.9% respectively. 82.5% women were having WC >80 cm, while among men 48.2% had their WC >90 cm. According to

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study conducted among Chennai urban population shows prevalence of central obesity of 46.6%.[10]

In the present study, the overall prevalence of abdominal obesity based on waist:hip ratio criteria showed that 40.46% were obese. The prevalence among women was significantly higher than that of men (78.0% vs. 0.2%). The difference was statistically significant (P<0.001).

In a study conducted in rural community of Tamil Nadu prevalence of waist hip ratio >1 among males in general population was 3.56% and among females (>0.85) 32%. Difference between male and female waist hip ratio was significantly high (P<0.05)[12] (Table 5).

In our study the overall prevalence of fasting blood sugar ≥126 mg/dl was seen in 9.47% of participants. It was in 9.5% men and 9.4% in women. 10.8% had impaired glucose tolerance. There was no significant difference between men and women as far as blood sugar level were concerned.

In contrast to our study Tamil Nadu study conducted in rural area showed that prevalence of diabetes was 5.99% which was less compared to our study. Out of these 56% were known cases of diabetes mellitus.

Another study conducted by ICMR - INDiab showed the prevalence of diabetes (both known and newly diagnosed) was 10.4% in Tamilnadu, 8.4% in Maharashtra, 5.3% in Jharkhand, and 13.6% in Chandigarh. The prevalence of prediabetes (impaired fasting glucose and/or impaired glucose tolerance) were 8.3%, 12.8%, 8.1% and 14.6% respectively[13] (Table 6).

Conclusion

Study results reported here reflect and support the common clinical observation that patients with higher BMI are at higher risk for having diabetes mellitus. It has been observed that Indians are highly susceptible to diabetes and other NCD risk even with only modest overweight, central obesity. As per World Health Organization (WHO) expert group, Asians have different associations between body mass indexes, the percentage of body fat and the health risk of type 2 diabetes as compared to the other populations.

In most Indians, BMI more than 23 kg/m^2 is associated with central obesity and coronary risk. Weight appears to be of fundamental importance in prevention of diabetes and reduction of weight is associated with lower BMI.

In this study we have used both Asian criteria for classification of BMI and WHO criteria also. Both the criteria's shows there is significant co relation of BMI with diabetes. In Asian criteria we find a greater number of overweight and obese persons than WHO criteria.

Way forward: we have found a positive correlation between fasting blood glucose level and BMI. Food habits, intensive lifestyle modifications and regular exercise may prevent new-onset of diabetes, especially in patients with high BMI and high glucose level. Implementing Asian criteria of classification of BMI, we will be able to find or detect a greater number of overweight and obese people. This may help in prompt treatment or preventive measures to avoid future complications.

Conflicts of Interests: None

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