

# “A Cross Sectional Study to Determine Overweight and Obesity among Medical Students and to correlate it with Parameters of Metabolic Syndrome”

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## ABSTRACT

**Background & Objective:** Overweight and obesity are becoming major problems in the developed as well as developing countries. In India about 30-65 % of adult urban Indians are reported to be either overweight or obese. Therefore the objectives of the study was to assess the prevalence of overweight, obesity and metabolic syndrome and determine the correlation between overweight, obesity and parameters of metabolic syndrome among medical students of Mandya Institute of Medical Sciences (MIMS), Mandya.

**Methods:** The data of the cross-sectional study includes physical measurements like height, weight, Waist Circumference (WC) and biochemical investigation like Fasting Blood Glucose (FBS), serum Triglyceride (TG) and High Density Lipoprotein-Cholesterol (HDL-C).

**Results:** Out of 304 students, 144 were male students (47.37%) and 160 (52.63%) were female students. The prevalence of underweight in the present study was found to be 16.5%, overweight 15.2%, obese 0.9% and metabolic syndrome was 6.25%. It was found that higher percentage (9.72%) of male students had metabolic syndrome as compared to 5 (3.13%) females.

**Conclusion:** Overweight and obese students had increased values of biochemical parameters as compared to students with normal BMI. Metabolic syndrome was more prevalent in males than in female students of MIMS, Mandya. Early detection of the individual components of metabolic syndrome would help in early treatment and prevention of progression to metabolic syndrome.

**Key Words:** Medical students; Overweight; Obesity; Metabolic syndrome and Physical measurements.

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## INTRODUCTION

Overweight and obesity are rampant in the current world scenario and threatening as the major risk factors for many diet-related non communicable diseases (NCDs) like type 2 diabetes, cardiovascular disease, hypertension, stroke and certain forms of cancer<sup>[1]</sup>. The causes for obesity and overweight being physical inactivity, unhealthy diet, genetic predisposition, behavioral factors like tobacco, alcohol and stress<sup>[2]</sup>. In India the age of onset of obesity is progressively decreasing over the past years and the young individuals are being predisposed to obesity related health problems. About 30-65 % of adult urban Indians are reported to be either overweight or obese<sup>[3]</sup>.

Obesity is one of the most significant contributors of morbid conditions like metabolic syndrome. Metabolic syndrome is a group of disorders characterized by obesity, hypertension, glucose intolerance, and dyslipidemia<sup>[4]</sup>. Criteria for diagnosing metabolic syndrome are given by National Cholesterol Education Program (NCEP) and Adult Treatment Panel (ATP) III

guidelines that involve waist circumference (WC), Blood Pressure (BP), HDL-C, TG, and FBS<sup>[5]</sup>.

The prevalence of metabolic syndrome in obese adolescents has been reported to be between 18 % and 42 %. Abdominal obesity is a marker of dysfunctional adipose tissue and is of central importance in the clinical diagnosis of metabolic syndrome<sup>[6]</sup>.

The age group from 18-21 years is important physically, mentally and emotionally. This is the period of transition when individuals are entering adulthood. Medical students joining Medical Colleges represent this group<sup>[7]</sup>. In this age group, students may not consume an adequate diet and healthy diet or exercise regularly and usually skip their breakfast. Their diet is high in fat, sodium and sugar because of frequent snacking and consumption of fast food<sup>[8]</sup>.

As there are few studies in India on obesity and metabolic syndrome among medical students who require early intervention to prevent these diseases among the future doctors, the present study was undertaken with the objective was to assess the prevalence of overweight, obesity and metabolic syndrome among medical students and to determine correlation between overweight, obesity and parameters metabolic syndrome among medical students of MIMS, Mandya.

## MATERIALS AND METHODS

This cross sectional study was carried out on the medical students for a period of 3 months, after obtaining approval from the Institutional Scientific Committee and the Institutional Ethics Committee of MIMS, Mandya. A proforma was used to get information regarding demographic history, family history and anthropometric measurements like weight, height, Body Mass Index (BMI), BP, WC and biochemical investigations like FBS, TG and HDL-C. 304 students from all the phases of MBBS with completed proforma were included and

those who were not willing to be part of the study were excluded from the study.

### Physical Measurements

Height (cm) was measured using stadiometer, weight (kg) by analog weight scale, Systolic BP (SBP) and Diastolic BP (DBP) was measured using mercury sphygmomanometer, WC using measuring tape and BMI ( $\text{kg}/\text{m}^2$ ) calculated as  $\text{Weight in kg} / (\text{Height in m})^2$ . BMI was classified according to WHO (Table 1).

**Table 1: Classification of BMI according to WHO<sup>[9]</sup>**

| BMI         | Classification    | BMI Code |
|-------------|-------------------|----------|
| < 18.5      | Underweight       | 1        |
| 18.5–24.9   | Normal weight     | 2        |
| 25.0–29.9   | Overweight        | 3        |
| 30.0–34.9   | Class I obesity   | 4        |
| 35.0–39.9   | Class II obesity  | 5        |
| $\geq 40.0$ | Class III obesity | 6        |

### Collection of Blood Sample:

From selected subjects, 3ml of fasting venous blood sample was drawn under aseptic precautions into non-vacuum plain tubes with clot activator and were allowed to stand for about 25-30 minutes followed by centrifugation at 3500rpm for 15- 20 min. The serum was collected and these samples were processed in the Clinical Biochemistry section of Central Diagnostic Laboratory MIMS, Mandya using the fully automated random access clinical chem analyser XL- 300 (Transasia) for the testing of biochemical parameters. FBS was estimated by GOD-PAP methodology, serum TGs by GPO peroxidase methodology and HDL -C by

direct determination (enzyme selective protection method).

The reference range of FBS and lipid profile was applied from American Diabetes Association (ADA) & ATP III Criteria respectively<sup>[10]</sup>.

Metabolic syndrome was diagnosed using NCEP ATP III criteria that suggest that diagnosis of metabolic syndrome can be made in presence of any three of the following five components. Abdominal obesity can be measured by WC (males: >102 cm and females: >88 cm),

Serum TG > 150 mg/dL, HDL-C in males < 40 mg/dL and females < 50 mg/dL, BP  $\geq 130/85$  mm Hg, and FBS  $\geq 110$  mg/dL<sup>[5]</sup>.

The data was analyzed using descriptive statistics of SPSS analysis version 15 software. The result were analyzed using the Chi- square test and t test and p value of less than 0.05 was considered as statistically significant at 95% confident interval.

## RESULTS

In the present study a total of 304 students from 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> year MBBS, between the ages of 18-24, participated in the study. Among 304 MBBS students, 144 were male students (47.37%) and 160 (52.63%) were female students (Table 2).

**Table 2: Distribution of MBSS students according to year of study and gender**

| Year of Study        | Males  |      | Females |      | Total |
|----------------------|--------|------|---------|------|-------|
|                      | Number | %    | Number  | %    |       |
| 1 <sup>st</sup> year | 48     | 50.5 | 47      | 49.5 | 95    |
| 2 <sup>nd</sup> year | 40     | 46.5 | 46      | 53.5 | 86    |
| 3 <sup>rd</sup> year | 24     | 44.4 | 30      | 55.6 | 54    |
| 4 <sup>th</sup> year | 32     | 46.4 | 37      | 53.6 | 69    |

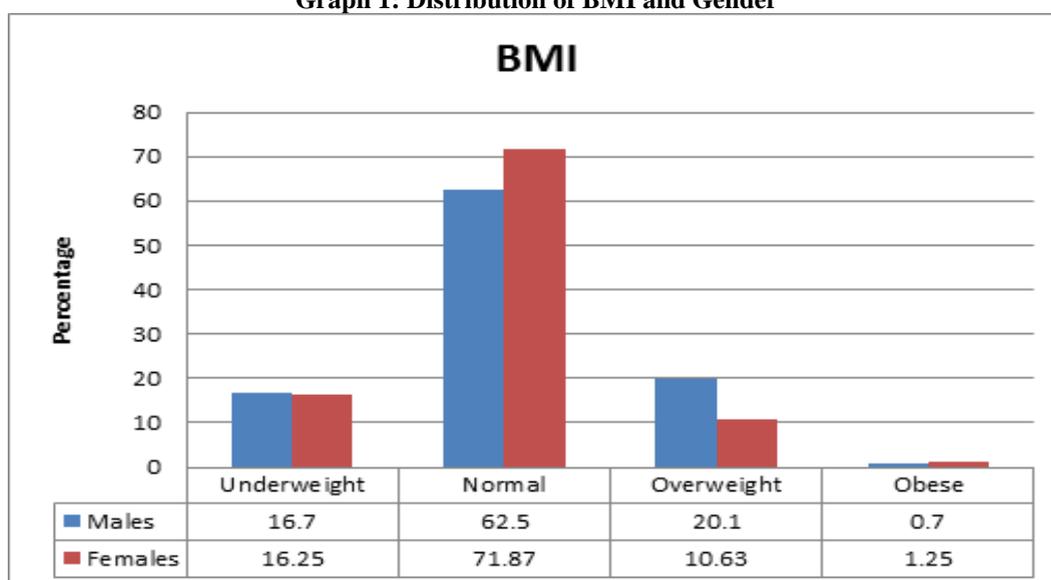
p > 0.05

The data revealed that, overall 50 (16.5%) students were underweight, 205 (67.4%) were normal, 46 (15.2%) were overweight (29 male and 17 female) and 3 (0.9%) were obese (Table 3).

**Table 3: BMI and year of study among MBBS students**

| Year of Study        | Underweight |             | Normal     |             | Overweight |             | Obese    |            |
|----------------------|-------------|-------------|------------|-------------|------------|-------------|----------|------------|
|                      | No.         | %           | No.        | %           | No.        | %           | No.      | %          |
| 1 <sup>st</sup> year | 23          | 24.2        | 58         | 61.1        | 14         | 14.7        | 0        | 0          |
| 2 <sup>nd</sup> year | 16          | 18.6        | 58         | 67.4        | 12         | 13.9        | 0        | 0          |
| 3 <sup>rd</sup> year | 7           | 12.9        | 36         | 66.6        | 9          | 16.6        | 2        | 3.7        |
| 4 <sup>th</sup> year | 4           | 5.7         | 53         | 76.8        | 11         | 15.9        | 1        | 1.4        |
| <b>Total</b>         | <b>50</b>   | <b>16.5</b> | <b>205</b> | <b>67.4</b> | <b>46</b>  | <b>15.2</b> | <b>3</b> | <b>0.9</b> |

As seen in **Graph 1**, 20.1% male and 10.63% female students were found to be overweight and among 304 students, 1 male and 2 female students were obese. With respect to BMI, there was no statistical significant difference observed between male and female students.

**Graph 1: Distribution of BMI and Gender**

$p > 0.05$

In our study it was found that, among 144 male students high TG (30.55%) and increased SBP (27.77) were present in higher percentage as compared to other components of metabolic syndrome. Similar findings were also observed in females. Among 160 female students high TG (40.63%) and increased SBP (9.37) were present in higher percentage as compared to other components of metabolic syndrome (**Table 4**).

**Table 4: Distribution of metabolic syndrome components among study subjects**

| Metabolic Syndrome Components | Males |       | Females |       | Total |
|-------------------------------|-------|-------|---------|-------|-------|
|                               | No.   | %     | No.     | %     |       |
| WC >102/88 cm                 | 3     | 2.08  | 3       | 1.87  | 6     |
| SBP ≥130mmHg                  | 40    | 27.77 | 15      | 9.37  | 55    |
| DBP ≥85mmHg                   | 30    | 20.83 | 6       | 3.75  | 36    |
| FBS >100mg/dl                 | 3     | 2.08  | 1       | 0.625 | 4     |
| TGC >150mg/dl                 | 44    | 30.55 | 65      | 40.63 | 109   |
| HDL-C <40/<50mg/dl            | 6     | 4.16  | 12      | 7.5   | 18    |

As seen in **Table 5**, mean values WC, SBP, DBP and FBS were found be higher among males as compared to female students and HDL –C was lower among males. On the contrary the mean value of TG was found be higher in females as compared to males. Mean values of WC, SBP and HDL –C showed statistically significant difference male and female students.

**Table 5: Distribution of mean values of metabolic syndrome components among study subjects**

| Metabolic Syndrome Components | Males Mean $\pm$ SD | Females Mean $\pm$ SD |
|-------------------------------|---------------------|-----------------------|
| WC* >102/88 cm                | 80.47 $\pm$ 9.7     | 71.75 $\pm$ 7.3       |
| SBP* $\geq$ 130 mmHg          | 119.32 $\pm$ 12.79  | 109.66 $\pm$ 10.54    |
| DBP $\geq$ 85 mmHg            | 77.63 $\pm$ 9.59    | 69.21 $\pm$ 8.71      |
| FBS >100 mg/dl                | 86.78 $\pm$ 8.7     | 84.32 $\pm$ 10.1      |
| TGC >150 mg/dl                | 133.1 $\pm$ 67.3    | 142.46 $\pm$ 58.16    |
| HDL-C* <40/<50 mg/dl          | 57.73 $\pm$ 10.41   | 66.22 $\pm$ 14.39     |

\* Statistically significant  $p < 0.05$

In the present study it was found that, WC was increased only among overweight and obese students. But the other components of metabolic syndrome were present in all the class of BMI (**Table 6**).

**Table 6: Distribution of metabolic syndrome components and BMI among study subjects**

| Metabolic Syndrome Components | Underweight | Normal | Overweight | Obese |
|-------------------------------|-------------|--------|------------|-------|
| WC >102/88 cm                 | 0           | 0      | 3          | 3     |
| SBP $\geq$ 130mmHg            | 6           | 29     | 17         | 3     |
| DBP $\geq$ 85mmHg             | 1           | 23     | 11         | 1     |
| FBS >100mg/dl                 | 1           | 1      | 2          | 0     |
| TGC >150mg/dl                 | 17          | 65     | 25         | 2     |
| HDL-C <40/<50mg/dl            | 2           | 11     | 5          | 0     |

As seen in **Table 7**, the mean values of metabolic syndrome components were increasing from underweight to obese and HDL- C was decreasing from underweight to obese. Mean values of metabolic syndrome components were higher among obese followed by overweight.

**Table 7: Distribution of mean values of metabolic syndrome components and BMI among study subjects**

| Metabolic Syndrome Components | Underweight       | Normal            | Overweight       | Obese           |
|-------------------------------|-------------------|-------------------|------------------|-----------------|
| WC >102/88 cm                 | 67.8 $\pm$ 7.9    | 75.1 $\pm$ 7.4    | 86.6 $\pm$ 9.1   | 93. $\pm$ 7.5   |
| SBP $\geq$ 130mmHg            | 109.7 $\pm$ 11.1  | 113.2 $\pm$ 11.9  | 122.1 $\pm$ 13.1 | 133.3 $\pm$ 5.7 |
| DBP $\geq$ 85mmHg             | 69.72 $\pm$ 7.8   | 72.5 $\pm$ 9.9    | 79.1 $\pm$ 9.8   | 86.6 $\pm$ 11.5 |
| FBS >100mg/dl                 | 83.3 $\pm$ 8.7    | 84.61 $\pm$ 9.5   | 86.8 $\pm$ 9.5   | 87.9 $\pm$ 9    |
| TGC >150mg/dl                 | 131.18 $\pm$ 60.5 | 134.02 $\pm$ 58.6 | 170.7 $\pm$ 73.9 | 174 $\pm$ 33.1  |
| HDL-C <40/<50mg/dl            | 65.4 $\pm$ 12.1   | 62.89 $\pm$ 13.8  | 56.2 $\pm$ 10.4  | 54 $\pm$ 3      |

In the present study it was found that, among 144 male students 14 (9.72%) had three components and 23 (15.97%) had two components of metabolic syndrome. None of the male students were positive for four and five components. Among 160 female students, one student had five components metabolic syndrome whereas 12 (7.5%) had two components, 3 (1.87%) had three components and 1(0.62%) had four components of metabolic syndrome (**Table 8**).

**Table 8: Distribution of number of metabolic syndrome components among study subjects**

| Metabolic Syndrome Components | Males  |       | Females |       | Total |
|-------------------------------|--------|-------|---------|-------|-------|
|                               | Number | %     | Number  | %     |       |
| 0                             | 69     | 47.9  | 83      | 51.87 | 152   |
| 1                             | 38     | 26.38 | 60      | 37.5  | 98    |
| 2                             | 23     | 15.97 | 12      | 7.5   | 35    |
| 3                             | 14     | 9.72  | 3       | 1.87  | 17    |
| 4                             | 0      | 0     | 1       | 0.62  | 1     |
| 5                             | 0      | 0     | 1       | 0.62  | 1     |

As seen in **Table 9**, it was found that 14 (9.72%) male students had metabolic syndrome as compared to 5 (3.13%) females and it was found to be statistically significant.

**Table 9: Distribution of metabolic syndrome among study subjects**

| Metabolic Syndrome | Males |       | Females |       | Total |
|--------------------|-------|-------|---------|-------|-------|
|                    | No.   | %     | No.     | %     |       |
| Present            | 14    | 9.72  | 5       | 3.13  | 19    |
| Absent             | 130   | 90.27 | 155     | 96.87 | 285   |

$p < 0.05$

## DISCUSSION

Obesity is a complex multifactorial chronic disease that develops from an interaction of social, behavioral, culture, psychological, metabolic and genetic factors. In preventive medicine overweight, obesity and metabolic syndrome have gained importance in recent years, as it predispose to NCDs like diabetes mellitus type 2, cardiovascular diseases and cerebrovascular stroke etc<sup>[11]</sup>. Obesity is the primary event in the occurrence of metabolic syndrome, especially increase in abdominal fat indicated by WC. Obesity is considered as a factor that leads to insulin resistance, diabetes mellitus, high BP, and dyslipidemia. Insulin resistance is said to be the key component for increased risk factors of metabolic syndrome<sup>[12]</sup>.

Excess weight and lack of physical activity are two important determinants of the metabolic syndrome. On the other hand, chronic stress has been recently reported to be associated with the syndrome, especially in the work environment. Since medical students generally spend a large part of the day at the medical college hospital attending lectures, practical's and residing at the hostel during the study period, hence it is characterized by high levels of sedentariness and stress that may represent an important risk factor<sup>[13]</sup>.

In our study we found that the prevalence of underweight was 16.5%, overweight was 15.2%, and 0.9% was obese. This is in contrast to Geetha M she reported lower prevalence (10%) underweight and higher prevalence of 24% overweight and 9.3% were obese<sup>[14]</sup>. Prevalence of metabolic syndrome in our study in medical students was only 6.25% and with male predominance. This is in concurrence with the previous study done by Patel N et al, he showed that, 5.9% was the prevalence of metabolic syndrome and 100% male preponderance<sup>[15]</sup>. Patel N et

al in his study he explained less percentage of metabolic syndrome cases in female. It is due to hormonal protection as most of females are below menopausal age and more awareness about diet and exercise in young group of female<sup>[15]</sup>.

In the present study it was found that higher percentage of male students were having metabolic syndrome as compared to females. The main limitation of the present study is – small sample size. Further studies are needed with large population to compare the dietary habits, physical activities with biochemical parameters.

## CONCLUSION

In the present study even though the mean values of most of the metabolic syndrome components were within the normal reference range the increasing trend with increase in BMI is noteworthy and alarming. Therefore this important finding of this study help us to develop appropriate preventive measures and steps to prevent the medical students from becoming overweight or obese and avoid them from progressing to metabolic syndrome as well as developing other complications of obesity related disorders.

Prevalence of metabolic syndrome rises with advancement of age with male predominance. Overweight and obesity is one of the preventable causes of death and the morbidity associated with it is also enormous. Hence, identification of overweight, obesity and metabolic syndrome positive cases among the medical students and management with appropriate life-style modifications, dietary modifications, exercise and other physical education programs and drug therapy would help in reduction in obesity and obesity related disorders such as metabolic syndrome, diabetes mellitus and cardiovascular diseases.

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**CONFLICTS OF INTEREST:** None

## REFERENCES

1. Reis AF, Hauache OM, Velho G. Vitamin D endocrine system and the susceptibility to diabetes, obesity and vascular disease. A review of evidence. *Diabetes Metab* 2005; 31(4): 318-25.
2. KK Jalwar, Ashoo Grover, JS Thakur. Role of Medical Education in preventing and control of Non communicable Diseases in India. *Indian J. Community Med.* 2011;36:S63-6.
3. Misra A, Khurana L. Obesity and the metabolic syndrome in developing countries. *J Clin Endocrine Metab.* 2008;93:S9-30.
4. Mottillo S, Filion KB, Genest J, Joseph L, Pilote L, Poirier P, et.al. *JACC.* 2010; 56(14).
5. Expert Panel on Detection, Evaluation of and Treatment of High Blood Cholesterol in Adults. Executive summary of the Third Report of the National Cholesterol Education Program (NCEP). Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) *JAMA* 2001; 285(19): 2486-97.
6. Nasreddine L, Naja F, Tabet M, Habbal M-Z, Aida El-Aily A, Chrystel Haikal, Samira Sidani, Nada Adral & Nahla Hwalla. Obesity is associated with insulin resistance and components of the metabolic syndrome in Lebanese adolescents. *Annals of Human Biology.* 2012; 39(2): 122-8.
7. Physical status: The Use and Interpretation of Anthropometry - Report of a WHO Expert Committee, Geneva, World Health Organization 1995; 263-308.
8. Brunt A, Rhee Y, Zhong L: Differences in dietary patterns among college students according to body mass index. *J Am Coll Health.* 2008; 56: 29-634.
9. [http://www.who.int/dietphysicalactivity/childhood\\_what/en/](http://www.who.int/dietphysicalactivity/childhood_what/en/)
10. American Diabetes Association Recommendations. Available from [https://www.amc.edu/pathology\\_labservices/addenda/addenda\\_documents/Americandiabetesassociationrecommendations2.pdf](https://www.amc.edu/pathology_labservices/addenda/addenda_documents/Americandiabetesassociationrecommendations2.pdf).
11. Jayaraj, PP Nair, Napoleon R, Stephen J, K Nishanth, D Suresh. Prevalence of Overweight and Obesity among Students of a Medical College in South India: A Pilot Study. *Indian Journal of Clinical Practice.* 2014; 25(4): 333-7.
12. Salazar MR, Carbajal HA, Espeche WG, Dulbecco CA, Aizpurua M, Marillet AG, et al. Relationships among insulin resistance, obesity, diagnosis of the metabolic syndrome and cardio-metabolic risk. *Diab Vasc Dis Res.* 2011; 8(2):109-16.
13. Laaksonen DE, Lakka HM, Niskanen LK, Kumpusalo E, Tuomilehto J, Salonen JT. Metabolic syndrome and development of diabetes mellitus: application and validation of recently suggested definitions of the metabolic syndrome in a prospective cohort study. *Am J Epidemiol.* 2002; 156: 1070-7.
14. Geetha M. Assessment of Body Mass Index and its Associated Nutritional Factors among Undergraduate Medical Students in Tamil Nadu, India: A Cross-Sectional Study. *J PIONEER MED SCI.* 2014; 4(3): 137-142.
15. Patel N, Shah S, Shah SP. A Study on Assessment of Metabolic Syndrome Prevalence among Medical Students, Hospital Staff and Patients. *GCSMC J Med Sci.* 2015; 4(1): 33-36.