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Research article

GENDER DIFFERENCES IN BODY MASS INDEX AND BLOOD PRESSURE AMONG NORMAL HEALTHY UNDERGRADUATE STUDENTS

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ABSTRACT

Introduction: Obesity, measured by body mass index (BMI) is one of the morbid non-communicable diseases in the modern world. Worldwide reports have indicated a rise in the prevalence of obesity among adults. Generally it is believed that adolescence is the risky age for entering into the domain of obesity and females of this age group are more prone for this than their male counterparts. **Purpose:** Confirmation of this fact may help us in preventing or reducing the risk obesity by various methods like counselling on modification of lifestyle, planning of diet and choosing of exercise regime. **Methodology:** 74 normal healthy undergraduate students of both genders participated in this study (37 each). Blood pressure and heart rate (HR) were measured along with body mass index (BMI), basal metabolic rate (BMR) and body fat percentage (BFP) by using the Semi-Automatic BP Monitor and Body Fat Monitor (OMRON). **Result:** Mean BMI was more in females than in males but it was not statistically significant ($p < 0.275$). BFP was significantly more in females than in males ($p < 0.000$). Systolic blood pressure was less and HR was more in females than in males with high significance ($p < 0.000$). **Conclusion:** The results of the present study showed that adolescent age group (17 to 20 years) was not in the risk of obesity. However, the BMI values in both the genders are at the higher side nearing overweight. So awareness of susceptibility towards obesity must be created among this age group to avoid this morbidity.

Keywords: BMI, Obesity, Non-communicable diseases, Blood pressure, Rate-pressure product

INTRODUCTION

The Body Mass Index (BMI) is a statistical measurement to differentiate obesity and non-obese. Generally BMI and body fat go hand in hand. However, BMI does not express the quantity of fat in the body because, BMI depends upon the height and weight of the person and body fat depends upon the gender and age also. For example, one male and one female of the same age may have the same BMI but the fat content may be more in females than in males; similarly, BMI may be the same in older and younger group of people but the body fat may be more in older people than the younger ones[1].

Thus, BMI helps to identify the individuals with underweight, normal weight, overweight and obese[2] (Table 1). Identification of the obesity is important because it is considered to be a morbid non-communicable disease (NCD) in which the quality or/and the span of life of an individual is at risk[3, 4]

Table 1. Body status depending upon Body Mass Index

BMI (kg/meter^2)	Classification
< 18.5	Underweight
18.5 – 24.9	Normal weight
25.0 – 29.9	Over-weight
30.0 – 34.9	Class I obesity
35.0 – 39.9	Class II obesity
> 40.0	Class III obesity (Morbid obesity)

BMI – Body mass index

NCDs have become a greater threat to the human race than the communicable diseases in the modern world. The study of Global Burden of Disease (GBD) states that by 2020, deaths due to NCDs such as hypertension, diabetes mellitus, coronary heart diseases, stroke and metabolic disorders will be four times more than communicable diseases which are infectious, contagious and transmissible[5]. Obesity seems to be one of the common risk factors in many of these NCDs and considered to be the most prevailing and threatening public disaster in the developed countries[6].

At which period of life this threat of obesity starts is still a mystery because it varies from infancy to childhood, adolescence and adulthood[1]. The present study was planned on this basis.

Objectives of the study:

1. To screen the college going students (adolescents) for the prevalence of obesity, overweight and hypertension
2. If obesity and hypertension are in the vicinity, which gender is most affected?
3. If affected or on the verge of to be affected, how best it can be handled?

METHODS

Seventy four normal and healthy students of both sexes (thirty seven in each) were recruited from Shri Sathya Sai Medical College at Tiruporur and Madha Medical College and Research Institute at Kovur in Chennai, Tamil Nadu. Athletes, sports persons and the ones who were on treatment for any ailment were not included in the study. In females, mid follicular phase of menstrual cycle was chosen for the study. Ethical clearance was obtained from the institutions. The aim and essence of the research work were explained to them and their consent was obtained before proceeding with the work. They were instructed to report in Physiology laboratory in the forenoon after a light breakfast.

The data regarding their age and sex were noted and the weight and the height of the subject were measured. The weight was recorded with their casual clothes on. The height was measured by using a measuring scale drawn on the wall of the laboratory. The subjects were resting in a sitting position with uncrossed legs for five minutes before proceeding with the experiment.

Systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) were measured by using the Automatic BP Monitor (OMRON, Model HEM-7111). Body mass index (BMI), Basal Metabolic Rate (BMR) and Body Fat Percentage (BFP) were measured by using Body Fat Monitor (OMRON – Model HBF-306).

Statistical analysis: Computerized data analysis was done using SPSS 17.0 and the comparison was done in Students''t' test. Values are expressed as mean ± SD, Significance level was fixed at $p < 0.05$

RESULTS

Anthropometric parameters: The mean age of male and female subjects was similar (18.73 ± 1.97 and 18.19 ± 0.16 years) ($P < 0.077$). The height and weight of the male subjects were

significantly greater than that of females ($p < 0.000$ and 0.001) (Table 2)

BMI, BMR and BFP: The mean BMI was slightly less in males (21.33 ± 3.70 kg/m^2) than in females (22.18 ± 3.64 kg/m^2) but the difference was not statistically significant ($p < 0.275$). BMR was more in males (1553 ± 240.82 kcal) than in females (1282.42 ± 205.49 kcal) with statistical significance ($p < 0.000$). BFP was less in males (18.26 ± 5.53%) than in the females (28.90 ± 6.65%) and the difference was highly significant ($p < 0.000$) (Table 3).

Blood pressure : The mean SBP was more in males (117.97 ± 9.55 mm Hg) than in females (104.93 ± 9.26 mm Hg) and the difference was highly significant ($p < 0.000$). The DBP did not show any significant difference between the two groups ($p < 0.899$) The MAP was slightly more in males than in females with less statistical significance ($p < 0.034$) (Table 4)

Heart rate: HR was significantly less in males than in females ($p < 0.000$).

Rate-pressure product: The mean RPP was less in males than in females (8.91 ± 1.83 and 9. 30 ± 2.11) but it was not statistically significant ($p < 0.409$) (Table 4)

Table 2. Comparison of anthropometric parameters between males and females

Parameter	Male (37) (Mean ± SD	Female (37) (Mean ± SD	Significance
Age (years)	18.73 ± 1.97	18.19 ± 0.16	p < 0.077
Height (cm)	172.00 ± 7.65	154.45 ± 8.81	p < 0.000
Weight (kg)	62.99 ± 11.04	54.14 ± 10.46	p < 0.001

Table 3. Comparison of BMI, BMR and BFP between males and females

Parameter	Male (37) (Mean ± SD	Female (37) (Mean ± SD	Significance
BMI (kg/m^2)	21.33 ± 3.70	22.19 ± 3.64	p < 0.275
BMR (kcal)	1553.03 ± 240.8	1282.42± 205.49	p < 0.000
BFP (%)	18.26 ± 5.53	28.90 ± 6.65	p < 0.000

BMI – Body mass index, BMR – Basal metabolic rate, BFP - Body fat percentage

Table.4: Comparison of blood pressure (SBP, DBP & MAP), heart rate (HR), and rate-pressure product (RPP) between males and females

Parameter	Male (37) (Mean ± SD	Female (37) (Mean ± SD	Significance
SBP (mm Hg)	117.97 ± 9.55	104.93 ± 9.26	p < 0.000
DBP (mm Hg)	62.87 ± 8.67	62.58 ± 8.41	p < 0.899
MAP (mm Hg)	81.48 ± 7.99	76.72 ± 8.03	p < 0.034
HR (beats/min)	75.15 ± 12.13	88.42 ± 15.91	p < 0.000
RPP	8.91 ± 1.83	9.30 ± 2.11	p < 0.409

SBP – Systolic blood pressure, DBP – Diastolic blood pressure, MAP – Mean arterial pressure, RPP – Rate pressure product

DISCUSSION

The results of the present study are quite interesting and reveal the fact that the adolescent age group (17 and 20 years) is not at risk of obesity. Though the females showed more fat content than males ($p < 0.000$), their BMI was similar to that of males. However, in both the genders, BMI was within normal limits (18.5 – 24.5 kg/m^2)) indicating normal weight.

In one of the studies done in undergraduate students in Nigeria, the mean BMI was found to be higher in males (25.54 kg/m^2) than in females (23.38 kg/m^2) and in both sexes, BMI was found to be towards the overweight side[1]. Our results differ from this in that the males have lower BMI (21.33 ± 3.70 kg/m^2) and females have higher BMI (22.19 ± 3.64 kg/m^2) though it did not show the statistical significance. Moreover, none of our subjects were in the danger zone of overweight or obesity and the mean BMI was within normal range of 18.6 – 25 kg/m^2 (Table 3). As the mean age of Nigerian students was more (22 years) and the mean age of our subjects was less (18.5 years), we thought of the possibility of age-related influences on BMI.

But according to Kadri and Salako and Oghagbon etal8[7, 8], influence of age and gender difference has got nothing to do with BMI value. So the slightly increased mean BMI in females of our study group may be attributed to more fat content in them than in their male counterparts. As there is a possibility of further increase in fat content among females under the influence of estrogen[9] and as the tendency to weight gain is more in females than in males in the advancement of age[1], there is all chances for BMI to move towards the morbid side of obesity in females.

As far as blood pressure (BP) was concerned, in our study group, it was found to be within normal limits both in males and females and there was no report of hypertension. According to Oghagbon et al[8] and Lawoyin et al[10], overweight rather than obesity is more relevantly related to hypertension rather than BMI and fat content. In our study, higher SBP and MAP in males may be attributed to the more weight and height in them than in their female counterparts whose BMI and fat content were more than in males.

RPP is the interesting factor coupled with obesity in the present study. It is the product of SBP and HR and it has got its own significance because it represents the myocardial oxygen consumption (MVO2) that reflects the work load on the heart[11, 12]. It is calculated by the formula RPP = (HR X SBP) /100[13]. The hemodynamic of RPP, ie., HR and SBP are under the control of autonomic nervous system. HR is modulated by both sympathetic nervous system (SNS) and parasympathetic nervous systems and SBP is modulated by sympathetic nervous system. Lesser RPP indicates more parasympathetic activity[14]. Normally it should be 12 or below 12 with the HR ranging 60 – 120 bpm and SBP ranging 100 to 140 mm Hg[12]. In our study, in both the groups, RPP is well within normal limit. However, it is slightly less in males (8.91 ± 1.83) than in females (9.30 ± 2.11). Though the difference is not statistically significant, yet it has got its own functional significance because lesser RPP is an indicator of more PSN activity and increased parasympathetic tone is believed to be cardioprotective[14]. In the present study with their lower BMI, HR and RPP, males are armoured well against stress-induced cardiovascular changes.

Limitations of the study: There are a few drawbacks in the present study. Admittedly, the number of the subjects is less. Categorization of the subjects on their socioeconomic status and food habits could have been considered which may throw some light on the status of BMI and BP. The study is in progress to rectify these drawbacks and to include different age groups also.

CONCLUSION

- BMI was found to be within the normal range of our subjects.
- Though BMI is within normal range, both groups were towards the higher range showing susceptibility for obesity.
- Females showed higher BMI and BFP than the males. As overweight and obesity are age related and as there is possibility of weight gain in females during advancement of age, an orientation program becomes mandatory for the fresh undergraduate students regarding their health conditions in the form of a thorough medical check-up including BP monitoring and recording of BMI and BFP.
- Keeping in mind the modern sedentary lifestyle, poor nutrition and a lot of stress, implementation of awareness program regarding the causes, consequences, control and prevention of morbid obesity may be made mandatory for the youngsters.

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