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## Impact of Increased Body Mass Index and Cluster of Cardiovascular Risk Factors in the First Year Medical Students.

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### ABSTRACT

Obesity and weight gain arising in early childhood, is reflecting as the strong risk of cardiovascular diseases(CVD).Cardiovascular risk factors starts early, track through the young age and manifest in the middle age in most societies and has greater mortality also. Therefore to study CVD risk factors in the younger subjects were equally important in the older subjects in South Asians. So the aim of present study was to investigate the association of BMI with various cardiovascular risk factors. The present study was performed in the first year medical students of Krishna Institute of Medical Sciences Deemed University, Karad in the year 2011-2012.For Biochemical parameters 12 hr. fasting blood samples were collected and by using std. kit methods biochemical parameters were measured.BMI was calculated by measuring height and weight. Anthropometric parameter such as waist circumference (W.C), waist hip ratio (W/H) and neck circumference (N.C) was also measured by using std. methods. Systolic blood pressure, diastolic blood pressure and heart rate was (H.R) measured under basal condition. The percentage of male students was showing high prevalence of BMI (53.50%),W.C(42.30%),W/H(26.80%) and N.C(90.10%) while in female students high prevalence of BMI (48.10%),W.C(46.90%),W/H(48.10%) and N.C(28.40%) was observed.

**Keywords:** Body Mass Index, obesity, cardiovascular risk factors, anthropometric measurements.

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## INTRODUCTION

The global burden of cardiovascular diseases (CVD) is increasing rapidly and is becoming a leading cause of death [1]. It is expected that in the year 2020, CVD would prevail as the major cause of death over infectious disease [2]. CVD includes mainly atherosclerotic vascular diseases like coronary heart disease (CHD), cerebrovascular disease (CBVD) and peripheral arterial disease [3].

Obese individuals are more prone to many cardiovascular risk factors [4]. The prevalence of obesity among adolescents has increased gradually and is a major global public health problem, because of its health consequences and greater risk of obesity in adulthood [5-8]. Obesity is associated with hypertension, dyslipidemia and increased cardiovascular risk [9-12]. Type 2 diabetes mellitus is strongly associated with overweight and obesity [13-14]. Obese subjects have increased sympathetic activities, increased insulin resistance and activity of the rennin-angiotensin-aldosterone system [15]. The prevalence of these risk factors substantially increase with increasing BMI [16]. In addition to this the cardiovascular disease mortality is about 3 times higher among obese subjects [17-18]. To assess body fat distribution, there are computerized tomography (CT), magnetic resonance imaging (MRI) and double energy X-ray absorptiometry (DEXA). But the use of these techniques was limited due to their high cost. Neck circumference measures the excess body fat in upper region of body and waist hip ratio is the measure of excess body fat in the abdomen while BMI gives idea about generalized obesity. Recent study has shown that, amount of abdominal fat is influenced by genetic components, physical inactivity, abnormal eating habits like high calories intake, psychological factor etc [19].

Metabolic syndrome is special type of syndrome defined as presence of any three of the following-

1. Waist circumference 102 cm or more in males and 85cm or more in females.
2. Serum triglyceride (TG) level is 150mg % or above.
3. Serum high density lipoproteins (HDL) level is less than 40mg % for males and 50mg % in females.
4. Blood pressure is 135/85mm of Hg or more.
5. Fasting blood sugar level is above 100mg %.

There were about 10% cardiac surgeons in the year 1980, but now a days they are about more than 60% and every year about 25000 coronary bypass operations are being carried out in India [20].

So the aim of present study was to determine the prevalence of multiple cardiovascular risk factors and to assess the correlation between obesity and cardiovascular risk factors in the first year medical students.

## MATERIAL AND METHODS

The present work was carried out in the Department of Physiology and Biochemistry, Krishna Institute of Medical Sciences Deemed University, Karad during 2012-2013. Study protocol was approved by institutional ethics committee of KIMSUDU, Karad. Medical history, family history and personal history was recorded in the structured proforma.

Apparently healthy male and female students between age group 18-20 year, willing for this study were selected by taking their written consent. The subjects having any serious disorder like hypertension, cardiovascular disease, cancer, endocrinological disorder or any other marked disability were excluded from the study.

Total 152 students participated in the present study. Out of this 71 were male students and 81 were female students. They were categorized into normal weight and overweight according to BMI.

Body mass index (BMI) was calculated by using the formula –

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

Normal values of BMI were considered for male and female students were 23.6 and number of students showing high values were labeled as overweight [21].

**Table 1: Distribution of study group with respect to BMI**

Sex	Total no of students	Normal weight students	overweight students
Male students	71	33	38
Female students	81	42	39

Various anthropometric measurements like waist Circumference, neck circumference, and hip circumference were measured by using standard procedures.

**Neck circumference (N.C.):** The neck circumference was measured by using a non-stretch measuring tape (Sanny, Brazil). The subjects were asked to stand erect with their head positioned in the Frankfort horizontal plane. The upper edge of the measuring tape was placed just below the laryngeal prominence and applied perpendicularly to long axis of neck. Normal values of N.C. was consider for male students were 35 cm and for female student were 32 cm. and number of student showing high values were measured[22].

**Waist circumference (W.C.) and waist hip ratio (W/H):** Waist circumference was measured by using non-stretch steel tape at the level of midpoint of lower ribs and iliac crest in mid expiration in standing position, while hip circumference was measured at inter-trochanteric level. Normal values of W.C. was consider for male students were 102 cm and for female students were 85 cm. and number of students showing high values were measured[23].

**Measurement of B.P. and H.R.:** Blood pressure (B.P.) and heart rate (H.R.) were measured in the basal condition early in the morning between 7.30 am to 9.00 a.m. by auscultatory method using sphygmomanometer [24-25].

**Biochemical parameters**

**Collection of blood Sample**

For Biochemical investigations, 12 hr. fasting blood samples were collected by using disposable syringes and needles in the plain bulb for the estimation of lipid profile and for blood sugar in fluoride bulb (potassium oxalate + sodium fluoride). After two hours both the samples were centrifuged at 3000 rpm for 5 min and serum from plain bulb and plasma from anticoagulated blood were separated. Serum was used for lipid profile and Plasma was used for estimation of fasting blood sugar level [26].

- Serum total cholesterol was measured by CHOD-PAP method.
- Serum triglycerides were measured by GPO method.
- Serum HDL cholesterol was measured by immunoinhibition method.
- LDL cholesterol was calculated by using Friedwald formula[27].

The tests were carried out according to the manufacturer’s instructions. Measurement of serum cholesterol, triglyceride and HDL cholesterol was done by ERBA 360 fully automated analyzer.

**Statistical Analysis**

Descriptive statistics (minimum, maximum, mean, standard deviation) was determined for each variables. Comparison of study variables between normal weight and overweight students was done by using unpaired ‘t’ test. (ANOVA test was used for comparison of inter groups of study variable) In case of significant ‘F’ value Tukey Kramer multiple comparison test, the post- hoc test was applied. ‘p’ values less than 0.05 was considered as significant.

**RESULTS**

**Table 2: Percentage of male and female students showing high values of BMI, W.C, W/H, and N.C.**

S.No.	Parameter	Percentage of Students Showing high values	
		Male	Female
1	BMI	53.50 %	48.10 %
2	W.C (cm)	42.30 %	46.90 %
3	W/H	26.80 %	48.10 %
4	N.C (cm)	90.10 %	28.40 %

Percentage of male students showing high values for BMI (53.50%), W.C.(42.30%),W/H(26.80%), N.C.(90.10 %).Percentage of female students showing high values for BMI (48.10%), W.C.(46.90 %),W/H(48.10%), N.C.(28.40 %).

**Table 3: Mean and S.D. of W.C, W/H, N.C, SBP, DBP and H.R in normal weight and overweight male Students.**

Sr.No	Parameters	BMI (kg/m <sup>2</sup> )	
		Normal weight N = 33	Overweight N = 38
		≤ 23.6	≥23.61
1	W.C (cm)	80.39 ± 7.57 (64-94)	97.52 ± 10.57 *** (75-120)
2	W/H	0.82 ± 0.05 (69-0.93)	0.88 ± 0.04 *** (0.76-0.97)
3	N.C (cm)	36.12 ± 1.47 (33-40)	38.66 ± 1.69 *** (36-43)
4	SBP(mm of Hg)	121.15 ± 8.40 (110-140)	122.32 ± 10.17 (100-160)
5	DBP(mm of Hg)	82.12 ± 7.80 (70-90)	80.47 ± 5.83 (70-100)
6	H.R (beat/min)	75.0 ± 4.82 (66-88)	75.08 ± 4.91 (68-88)

Significant by Tukey Kramer multiple comparison test \* p<0.05, \*\* p<0.01,\*\*\* p<0.001.

When compared with normal weight students, overweight male students showed significant increase in W. C. (Tukey Kramer p<0.01), W/H (Tukey Kramer p<0.001), and N. C. (Tukey Kramer p<0.001). There was no significant difference was observed in SBP, DBP, H. R.

**Table 4: Mean and S.D. of FBSL, TC, TG, VLDL, LDL and HDL in normal weight and overweight male Students**

Sr.No.	Parameter	BMI (kg/m <sup>2</sup> )	
		Normal weight N=33	Overweight N=38
		≤ 23.6	≥23.61
1	FBSL (mg%)	88.45 ± 8.47 (64-104)	88.12 ± 10.78 (71-109)
2	TC (mg%)	156.12 ± 26.17 (111-217)	151.76 ± 22.51 (107-209)
3	TG (mg%)	124.64 ± 44.53 (69-232)	134.95 ± 46.51 (84-262)
4	VLDL (mg%)	24.78 ± 8.93 (14-46)	26.84 ± 9.32 (17-52)
5	LDL (mg%)	88.04 ± 22.90 (51-144)	86.82 ± 18.67 (47-124)
6	HDL (mg%)	42.85 ± 6.91 (29-55)	37.21 ± 6.29 *** (27-51)

Significant by Tukey Kramer multiple comparison test \* p<0.05, \*\*p<0.01,\*\*\* p<0.001.

When compared with normal weight male students, overweight students showed significant decrease in HDL (Tukey Kramer  $p < 0.001$ ). No significant difference was observed in FBSL, TC, TG, VLDL and LDL.

**Table 5: Mean and S.D. of W.C, W/H, N.C, SBP, DBP and H.R in normal weight and overweight female Students.**

Sr.No.	Parameters	BMI (kg/m <sup>2</sup> )	
		Normal weight N = 42	Overweight N = 39
		≤ 23.6	≥ 23.7
1	W.C (cm)	72.50 ± 7.86 (57-91)	86.79 ± 8.70 *** (65-100)
2	W/H	0.80 ± 0.06 (0.6-0.9)	0.82 ± 0.06 (0.70-0.94)
3	N.C (cm)	30.69 ± 1.98 (22-34)	32.92 ± 2.42 *** (30-39)
4	SBP(mm of Hg)	113.81 ± 5.82 (100-130)	114.56 ± 9.81 (100-145)
5	DBP(mm of Hg)	73.57 ± 5.76 (70-90)	75.54 ± 7.68 (70-90)
6	H.R (beat/min)	72.40 ± 5.76 (59-86)	74.13 ± 5.00 (64-92)

Significant by Tukey Kramer multiple comparison test \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

When compared with normal weight female students, overweight students showed significant increase in W. C. (Tukey Kramer  $p < 0.001$ ) and N. C. (Tukey Kramer  $p < 0.001$ ). There was no significant change was observed in W/H, SBP, DBP, H. R.

**Table 6: Mean and S.D. of FBSL, TC, TG, VLDL, LDL and HDL in normal weight and overweight female students.**

Sr.No.	Parameter	BMI (kg/m <sup>2</sup> )	
		Normal weight N=42	Overweight N=39
		≤ 23.20	≥ 23.21
1	FBSL (mg%)	80.57 ± 7.64 (63-92)	84.54 ± 7.9 * (69-101)
2	TC (mg%)	154.79 ± 26.58 (107-230)	154.56 ± 22.15 (114-219)
3	TG (mg%)	89.14 ± 25.33 (51-175)	107.85 ± 28.09 ** (62-168)
4	VLDL (mg%)	17.67 ± 5.00 (10-35)	21.44 ± 5.58 ** (12-34)
5	LDL (mg%)	84.33 ± 19.74 (45-130)	87.23 ± 18.73 (41-130)
6	HDL (mg%)	51.69 ± 10.54 (36-75)	44.90 ± 7.44 *** (29-71)

Significant by Tukey Kramer multiple comparison test \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

When compared with normal weight female students, overweight students showed significant increase in Fasting BSL (Tukey Kramer  $p < 0.05$ ), TG (Tukey Kramer  $p < 0.01$ ), VLDL (Tukey Kramer  $p < 0.01$ ), and significant decrease in HDL (Tukey Kramer  $p < 0.001$ ). No significant difference was observed in TC and LDL.

### DISCUSSION

One of the most common problems related to life style is being overweight. Obesity is the key risk factor in the development of many chronic conditions such as heart diseases, respiratory diseases, type 2 diabetes, hypertension and some cancers as well. Evidences suggest that the prevalence of overweight and

obesity is rising dramatically worldwide and the problem appears to be increasing rapidly in children as well as in adults [28].

In the present study, it was observed that high prevalence of obesity was 53.0 % in males and 48.10 % in females (Table-1). It may be due to sedentary life style, eating junk food like pizza, burger etc. are the major causes for prevalence of obesity. These changes are attributed to decrease in consumption of grain product, green vegetables and legumes together with an increase in consumption of meat, fat, dairy and bakery products [29-30].

The most comprehensive data on the prevalence of obesity worldwide are those of MONICA Project (monitoring of trends and determinants in cardiovascular disease study) of the world health organization [31]. The data Show that prevalence of obesity in most European countries is increased by about [32]. The most alarming increase has been observed in United Kingdom, where nearly two thirds of adult men are overweight or obese[33].The prevalence of obesity in our study was similar to that in other part of Saudi Arabia[34],in the province of Latina (Italy)[35],The United States[36] England and Australia[37].

Our study also shows that high prevalence of W.C, W/H N.C and it was 42.30%, 26.80%, 90.10% in male students respectively while 46.90%, 48.10%, and 28.40% in female Students respectively. (Table 2)

Obesity is associated with excessive fat accumulation in the body to the extent that affects health and well-being adversely because of changing food habits and sedentary lifestyle[38]. So to evaluate the effects of excess weight on health should consider the distribution of body fat as well as the amount of adipose tissue.C.T and MRI are the gold standard methods used to evaluated body fat distribution but waist and waist hip ratio are the indicators most commonly used to predict visceral fat accumulation in epidemiological studies[39-40].

When normal weight male students compared with overweight male students significant increase was observed in W.C ( $p<0.001$ ), W/H ( $p<0.001$ ) and N.C ( $p<0.001$ ) and N.C ( $p<0.001$ ). (Table 3) and when normal weight female students compared with overweight female students significant increase was observed in W.C ( $p<0.001$ ), W/H ( $p<0.001$ ) and N.C ( $p<0.001$ ). (Table5) Abdominal fat has been associated with insulin resistance, hypertension, certain type of cancer and osteoporosis [41]. So abdominal fat is an important and independent risk factor for chronic diseases [42].Waist circumference is useful in those individuals who were categorized as normal or overweight in terms of BMI. Waist hip ratio as a surrogate marker of abdominal obesity and high BMI was considered to be a marker of insulin resistance [43]. So in our study when normal weight female students compared with overweight female students it was observed that significant increase in blood sugar level ( $p<0.05$ ) (Table 6) and no significant change was observed in overweight male students when compared with normal weight male students (Table 4).

Chehrai et-al [44] also observed a positive correlation of waist hip ratio with increase in BMI. Findings of Depres JP [45], Folsom AR[46] also correlate with our Study.

It was recently proposed that N.C may represent a better parameter of cardiovascular risk when compare to fat stored in the visceral region. Possibly because visceral fat is not the major source of free fatty acids circulating levels. Furthermore it was demonstrated that the upper part of obesity (neck) is responsible for greater release of systematic free fatty acids. Therefore increase in neck circumference is closely associated with various metabolic disorder and there was negative repercussion of both metabolic and cardiovascular seems and muscle strength also[47]. So there is increased levels of LDL cholesterol, triglycerides, and low level of HDL cholesterol.

When normal weight female Students compared with overweight female students, significant increase was noticed in TG ( $p<0.01$ ) and VLDL ( $p<0.01$ ) and significant decrease in HDL ( $p<0.001$ ) (Table 6). And when normal weight male students compared with overweight male students, significant decrease was noticed in HDL ( $p< 0.001$ ). (Table 4)

This results are consistent with previous investigations by Boreham et al in 2001 , Katzmarzyk et al in 1999, Sallisetay in 1988.The Framingham offspring study also noticed cluster of CHD risk factors such as increased TG, decreased HDL, hyperinsulinemia, glucose intolerance and hypertension[48].

A 10% increase in body weight is associated with decline in parasympathetic tone accompanied by rise in heart rate and blood pressure[49]. Fat cells release free fatty acids which may stimulate hepatic triglycerides and very low density lipoproteins cholesterol production in adults and children also[50]. Factors linking with obesity are responsible for increase in blood pressure, increase in total blood volume and cardiac output. Which is caused by increase in metabolic demand, peripheral vascular resistance, endothelial dysfunction, interleukin 6, tissue necrotic factor, increased sympathetic tone, insulin resistance also [51].

There are various studies which show positive co-relation of BMI with B.P (systolic and diastolic) and heart rate [52] but our study does not correlate with these studies because we did not find significant changes in B.P and H.R.

In Western Maharashtra very few reports are available regarding the study of various risk factors of CVD in the medical students. This is small scale study and there is need for large scale research on the same topic to know the exact extent of the problems. Knowledge of which will be helpful to plan a program that will prevent metabolic syndrome. Prevention programs should make the students aware about nutrition and exercise that helps to maintain the positive health.

### CONCLUSION

The present study shows, escalation of multiple cardiovascular risk factors including increased N.C,W.C,W/H in younger age also. That is there is upper part and central obesity along with biochemical risk factors like increased TG,VLDL,TC and decreased HDL which is similar to others studies. So there is need for making younger generation aware about nutrition and increase physical activity. It was proved that consumption of omega – 3 fatty acids, increasing dietary fibers, fruits, vegetables cereals, oats, whole grains and antioxidant food such as carotenoids and vitamins C, E lower the CHD risk. Aerobic exercise directly increases the energy expenditure and is useful for long term weight regulation.

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