Original Research Article

A study on lipid profile and anthropometric measurements in medical students

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Abstract

Background: Overweight and obesity in youth is a worldwide public health problem. Predisposition to obesity starts during the first or second decade of life1. Overweight and obesity in adolescents have a substantial effect upon many systems, resulting in clinical conditions such as metabolic syndrome, early atherosclerosis, dyslipidaemia, hypertension and type 2 diabetes mellitus2. Our study aims at finding the relation between anthropometric measurements and lipid profile in medical students in their adolescence and see for the correlation between the various parameters. **Materials and Methods:** 150 students who gave written voluntary consent were included in the study. Anthropometric measurements (BMI, waist circumference and waist to hip ratio) were taken along with fasting blood samples for estimation of blood glucose and lipid profile (Total cholesterol, HDL-cholesterol, LDL-cholesterol, VLDL-cholesterol and triacylglycerol) were measured. **Observations and Results:** The data collected was analysed using SPSS statistics software version 20. A linear correlation regression analysis was done to know the correlation between the anthropometric measurements and biochemical parameters. Anova test was performed to know the significance and a p value of < 0.01 was taken as significant. All the biochemical parameters showed a positive correlation with anthropometric measurements with total cholesterol showing the highest positive correlation with BMI. There was a prevalence of 45% overweight/obesity (with any one of the anthropometric measurements). Individuals who were in the obese category as per all three parameters had a higher prevalence of abnormal lipid profile especially Total Cholesterol. **Conclusion:** Stress and lack of physical activity have a detrimental effect on health and are a major risk factor for development of obesity. 90% of the students in this study did not have any regular physical activity. Educating the students about effects of obesity and dyslipidaemia on quality of health can help in bringing life style modifications which can help them in the long run.

Key Words: BMI – Body Mass Index, WC – Waist circumference, WHR – Waist to hip ratio, LDL – Low density lipoprotein, HDL – High density lipoproteins, VLDL – Very low density lipoproteins

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INTRODUCTION

Different population have diverse patterns of relationships between Impaired Fasting Glucose, obesity and lipid markers. It is a matter of great concern that adult obesity has a strong genetic predisposition. However, this predisposition to obesity starts as early as the first or second decade of life[1].Overweight and obesity in youth is a worldwide public health problem. Overweight and obesity in childhood and adolescents have a substantial effect upon many systems, resulting in clinical conditions such as metabolic syndrome, early atherosclerosis, dyslipidaemia, hypertension, and type 2 diabetes mellitus[2]. It is important to find the correlation between anthropometric measurements, lipid profile and glycaemic levels in medical population, especially the first-year medical students, because they are exposed to mental stress and lack of physical activity during their

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previous two to three years of education. These factors add upon the risk of developing metabolic disorders like diabetes mellitus, obesity and dyslipidaemia at an early age[3].Detecting these abnormalities at an early age would provide a chance to make necessary lifestyle modifications and follow-up, which can prevent the metabolic disorders and their complications[4,5,6,7].

AIMS AND OBJECTIVES

To measure the anthropometric profile, this includes Body mass index (BMI), Waist circumference (WC), Waist to Hip ratio (WHR).
To estimate Fasting blood glucose and lipid profile.
To compare Fasting blood glucose, lipid profile with anthropometric measurements.

MATERIALS AND METHODS

Sample Size: 150 students in the age group 18-20 years.
Selection of students: 1st year M.B.B.S students were explained about the study and students who gave consent were included in the study.
Study place: Department of Biochemistry, Saveetha Medical College Hospital, Thandalam.
Study Method: 150 students who gave written voluntary consent to participate in the study were instructed to come in the morning by 8.00AM after an overnight fasting of 10-12 hours to the Department of Biochemistry. 3ml of venous blood sample was collected from each student after confirming that they were on fasting of 10-12 hours. The samples were centrifuged at 2000rpm for 10 minutes and the serum was transferred to separate aliquots. Meanwhile anthropometric measurements for all girls were taken by a female doctor and for boys by a male doctor. Fasting blood glucose and lipid profile were estimated on the same day. Anthropometric measurements: Height was measured to the nearest 0.1cm, while the subject was standing in an erect position, bare foot on a flat floor, against a vertical scale, with heels touching the wall and straight head. The body weight was measured using a weighing scale (Krups weighing machine), while the subject was standing motion less, formally clothed and without shoes on a weighing scale and it was recorded to the nearest 0.1kg. Body mass index was calculated using the formula BMI = weight (kg)/ height (m2)[8]. The cutoff values for obesity was more than 95th percentile in adolescents and over-weight was greater than or equal to 85th percentile[8].Waist circumference (WC in cm) was measured at a point which was mid-way between the lower rib and iliac crest, with the measuring tape centrally positioned at the level of umbilicus. Waist circumference was the average of two measurements, one which was taken after inspiration and another which was taken following expiration in standing position[9].Waist-Hip ratio (WHR) was calculated to assess central obesity. Hip circumference was measured (in cm) at tochanter major of the head of femur. WHR was calculated by using the formula to assess central obesity. WHR = Waist circumference (cm)/ Hip circumference (cm)[10]. Cut-off point of ≥90th percentile was used to define WC (males: > 82.5 cm; females > 76 cm), high WHR (males > 0.88; females > 0.82)[11].Following investigations were done in the Clinical Biochemistry laboratory: Fasting blood glucose was measured by Enzymatic Glucose oxidase – peroxidase method[12].Serum Total Cholesterol was measured by Enzymatic Cholesterol oxidase – peroxidase method[13].Serum Triacylglycerol was measured by Enzymatic colorimetric method[14].Serum HDL-Cholesterol was measured by Precipitation method[15].LDL and VLDL-Cholesterol were estimated using Friedwald's formula[16].

OBSERVATIONS AND RESULTS

The data collected was entered in an excel sheet (Microsoft office excel 2016). A total of 150 M.B.B.S students participated in the study of which 82 were females and 68 were males. The data was analysed using SPSS statistics software version 20. A linear correlation regression analysis was done to know the correlation between the parameters measured. Significance was calculated using Anova test and Student t-test and p value < 0.01 was taken as significant. The data collected was divided into two groups of males and females respectively. Table-1 and 2 shows the respective mean and standard deviation of for the parameters measured. Table -3 shows the mean and standard deviation for both males and females. Though males had a higher mean for all parameters measured, there was no significant difference in the parameters (p value > 0.05) between the two groups.

Table 1: Male students parameters (n=68)

Parameter	Minimum	Maximum	Mean	Std. Deviation
BMI(kg/m2)	15	34	22.01	3.614
WC(cms)	56	106	78.82	10.767
WHR	0.70	0.97	0.8222	0.05629
Total Cholesterol(mg/dl)	110	224	162.21	28.861
HDL (mg/dl)	40	63	50.00	5.175
VLDL (mg/dl)	10	27	15.97	3.730

LDL (mg/dl)	43	152	96.24	25.116
TAG (mg/dl)	52	132	79.46	18.085
FBS (mg/dl)	56	99	78.49	10.592

Table-2 Female Student parameters (n=82)

Parameter	Minimum	Maximum	Mean	Std. Deviation
BMI (kg/m2)	15	34	21.89	3.583
WC(cms)	57	111	72.44	8.607
WHR	0.60	1.04	0.742	0.056
Total Cholesterol (mg/dl)	104	235	159.7	29.9
HDL (mg/dl)	39	63	50.74	5.418
VLDL (mg/dl)	10	27	16.20	3.125
LDL (mg/dl)	52	154	92.76	26.715
TAG (mg/dl)	51	137	80.76	15.385
FBS (mg/dl)	59	98	81.10	10.288

Table 3: Male and female student parameters (n=150)

Parameter	Minimum	Maximum	Mean	Std. Deviation
BMI	15	34	21.95	3.586
WC(cms)	56	111	75.33	10.128
WHR	0.60	1.04	0.7784	0.06917
TC	104	235	160.83	29.367
HDL	39	63	50.41	5.304
VLDL	10	27	16.09	3.402
LDL	43	154	94.33	25.974
TAG	51	137	80.17	16.618
FBS	56	99	79.91	10.473

Cut-offs for BMI, Waist circumference and waist to Hip ratio were applied to categorize them into normal and obese. According to the cut-off for BMI, the prevalence of over-weight and obese was 38.2% in males and 40.2% in females. The overall prevalence was 39.3%. Individuals above waist circumference cut-off were 29.5% in males and 31.7% in females. Individuals above Waist to Hip ratio cut-off were 14.7% in males and 4.9% in females. Table-4 shows the number students along with the percentage prevalence falling in the respective categories for males and females.

Table 4 Anthropometric measurements along with cut-off and number of students in the respective groups

Parameter	Cut-off	Males	Females	Total
BMI	Underweight(< 18.5 kg/m^2)	9	16	25
	Normal (18.5 – 22.9 kg/ m^2)	33	33	66
	Overweight (> 23 kg/m^2)	26	33	59
Waist circumference Normal	Normal < 82.5 cm(males) < 76 cm (females)	48	56	104
Obese	Obese > 82.5 cm (males) > 76 cm (females)	20	26	46
Waist to hip ratio	Normal < 0.88 (males) < 0.82 (females)	58	78	136
	Obese >0.88 (males) >0.82 (females)	10	4	14

A linear correlation regression analysis was done to know the correlation between the anthropometric measurements and biochemical parameters measures and Anova test was performed to know the significance and a p value of < 0.01 was taken as significant.

Correlation between the parameters measured

1. **Correlation between BMI and other parameters:** BMI had a positive correlation with all the parameters measured. BMI had the strongest correlation with Total cholesterol (R value +0.847). Though there was a positive correlation with HDL-cholesterol the association was not significant (p value > 0.01). p value was < 0.001 for the remaining parameters except fasting blood glucose (p value 0.001). Table-5 shows the correlation (R value) and the significance of association (p value) between BMI and other parameters.

Table-5 correlation between BMI and other parameters

Sl.No	Correlation	R value	R Square	P value
1	BMI - WC	+0.822	0.676	<0.001
2	BMI - WHR	+0.453	0.205	<0.001
3	BMI - TC	+0.847	0.718	<0.001
4	BMI - HDL	+0.206	0.042	0.012
5	BMI - VLDL	+0.768	0.590	<0.001
6	BMI – LDL	+0.815	0.665	<0.001
7	BMI – TAG	+0.767	0.589	<0.001
8	BMI – FBS	+0.262	0.069	0.001

2. Correlation between waist circumference and other parameters: Waist circumference had a positive correlation with all the parameters. Waist circumference had the strongest correlation with BMI (R value +0.822). Though there was a positive correlation with HDL-cholesterol and fasting blood glucose, the association was not significant (p value >0.05). p value was <0.001 for the remaining parameters. Table-6 shows the correlation (R value) and significance of association between waist circumference and other parameters.

Table-6 correlation between WC and other parameters

Sl.No	Correlation	R Value	R Square	P value
1	WC - WHR	+0.792	0.628	<0.001
2	WC - TC	+0.653	0.427	<0.001
3	WC - HDL	+0.114	0.013	0.164
4	WC - VLDL	+0.650	0.430	<0.001
5	WC - LDL	+0.630	0.396	<0.001
6	WC - TAG	+0.647	0.419	<0.001
7	WC - FBS	+0.164	0.027	0.045

3. Correlation between WHR and other parameters: WHR had a positive correlation with all the parameters measured. The strongest correlation was with waist circumference (R value +0.792). Though there was a positive correlation between WHR and HDL-cholesterol and fasting blood glucose, the association was not significant (p value >0.05). p value was <0.001 for the remaining parameters. Table-7 shows the correlation (R value) and significance of association between WHR and other parameters.

Table 7: Correlation between WHR and other parameters

Sl.No	Correlation	R value	R Square	P value
1	WHR - TC	+0.331	0.110	<0.001
2	WHR - HDL	+0.021	0.000	0.796
3	WHR - VLDL	+0.354	0.125	<0.001
4	WHR - LDL	+0.332	0.110	<0.001
5	WHR - TAG	+0.352	0.124	<0.001
6	WHR - FBS	+0.051	0.003	0.539

4. Correlation of Lipid profile with anthropometric measurements: All the components of lipid profile had a positive correlation with anthropometric measurements. HDL-cholesterol was the only parameter which did not show any significant association (p value >0.05) with any of the anthropometric measurements despite of having a positive correlation. Remaining parameters of lipid profile had a significant association (p value < 0.001) with the anthropometric measurements. Total cholesterol followed by LDL-cholesterol had the strongest correlation with anthropometric measurements.

5. Correlation of Fasting blood glucose with anthropometric measurements: Fasting blood glucose had a positive correlation with all the parameters. Fasting blood Glucose had a significant association with BMI (p value 0.001). None of the students had a fasting blood glucose of > 100mg/dl. FBS had a positive correlation with waist circumference and WHR but the association was not significant (p value 0.045 and 0.539 respectively).

DISCUSSION

This study was conducted to know the influence of anthropometric measurements on lipid profile and fasting blood glucose and the correlation between individual parameters in medical students. BMI, waist circumference and waist to hip ratio were the anthropometric data collected. BMI is the most commonly used indicator of obesity in population studies, although it is not the most accurate one. It does not take into account body fat patterning such as waist size and waist to hip ratio[17]. So, waist circumference and waist to hip ratio which give an idea of central obesity were also measured. Anthropometric cu-offs[8,9,10,11] when applied to the current study group yielded a prevalence of 18% overweight (BMI 23-24.9 kg/m2) and 21.3% obese (BMI > 25kg/m2), as per waist circumference 30.7% were obese and as per WHR only 9.3% were obese. Kurpad SS *et al.* in their study on correlation of waist circumference and waist to hip ratio with BMI reported that waist circumference correlated better with BMI than waist to hip ratio[18]. This is in accordance with the current study, that in the correlation between three anthropometric measurements, BMI had a stronger correlation with wasit circumference than waist to hip ratio. All the parameters of lipid profile had appositive correlation with anthropometric measurements. BMI had the strongest association with Total cholesterol (R value +0.847). BMI had the strongest correlation with lipid profile than waist circumference and waist to hip ratio. Individuals with BMI > 23kg/m2 had higher total, LDL, VLDL cholesterol and triglycerides than individuals with BMI < 23kg/m2. The mean total, LDL, VLDL cholesterol and triglycerides were significantly high in overweight group (BMI > 23 kg/m2).

		Mean	Standard deviation
BMI < 23kg/m2	Total Cholesterol	148.25	21.29
	HDL-cholesterol	50.02	5.17
	LDL-cholesterol	83.58	19.53
	Triacylglycerol	73.08	10.21
BMI > 23kg/m2	Total Cholesterol	193.19	20.99
	HDL-cholesterol	51.45	5.64
	LDL-cholesterol	121.9	18.76
	Triacylglycerol	98.43	16.15

HDL-cholesterol was almost the same in obese and non-obese groups irrespective of the anthropometric measurements. Anthropometric measurements had a significant association (p value > 0.001) with all the parameters except HDL-cholesterol. HDL-cholesterol in this group was within normal range. This might be because of the age of the study population as all of them are in adolescent age group and similar findings were reported by de Novaes JF *et al.*[19]Adolescents who were in obese category with respect to all three anthropometric profiles had a higher prevalence of abnormal lipid profile, especially Total cholesterol. Results of the European fat distribution study[20] and Paris prospective study[21] established significant association between increased abdominal fat and greater WHR with respect to cardiovascular and coronary heart disease mortality. Various studies state that obese subjects on average have higher serum Total cholesterol, lower HDL- cholesterol, higher serum triglycerides and higher blood glucose than lean persons[22]. Combined measurements of BMI and waist circumference have been reported to a higher overall cardiovascular risk prediction, particularly in younger subjects[23,24]. Similar findings were observed in the current study group. Lipid profile had a higher mean among all the biochemical parameters in obese individuals than normal individuals. Lipid abnormalities such as, high Total cholesterol, LDL-cholesterol and low HDL-cholesterol are the most important cardiovascular risk factors[25]. INTERHEART study reported that high ratio of apo-A to apo-B is a more important lipid risk factor in South Asian subjects[26]. The current study did not include apolipoprotein estimation. In this study there was no evidence of impaired blood glucose. Fasting blood glucose levels were < 100mg/dl in all the subjects. There was no significant association between fasting blood glucose and any parameter except with BMI. As all the individuals of this study were adolescents, blood glucose levels were in normal range though there was dyslipidaemia. So, apparently healthy individuals with obesity may exhibit dyslipidaemia without an impaired

blood glucose. Similar findings were reported in three different studies[27,28,29]. Obesity especially during childhood and adolescence has a long-term impact on all the systems[30] and leads to the development of metabolic syndrome[31].Approximately 75% of urban adolescents and young adults were recently reported to be sedentary[32]. In this study both the obese and normal groups did not have regular physical activity, amounting to 90% of the study population. There was no significant difference of lifestyle between both groups. Sedentary habits, overweight or obesity increases the risk of non-communicable diseases like metabolic syndrome, hypertension, diabetes mellitus[33,34]. India is in a "second stage" of epidemiologic transition, accumulating a high burden of non-communicable diseases[35,36].This study has showed a prevalence of 45% overweight/obesity (with anyone of the anthropometric measurements). Various studies have shown a prevalence of 5-50% obesity in adolescents[37,38].This study has its limitations as the population was only 150 students and all were medical students.

CONCLUSION

Stress and lack of physical activity have a detrimental effect on health and are a major risk factor for development of obesity. 90% of the students in this study did not have any regular physical activity. Lack of physical activity, stress and coming from a high-risk ethnicity group i.e., South Asians[37,38] may have led to a high prevalence of overweight or obesity in this group. Factors that alleviate chronic stress and anxiety would help in preventing or delaying the entry of obese adolescents into insulin resistance that ends in type 2 diabetes mellitus[39]. Educating the students about effects of obesity and dyslipidaemia on quality of health can help in bringing about life style modifications which can help them in the long run.

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