ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

Published by JK Welfare & Pharmascope Foundation Journal Home Page: www.ijrps.com

A study on the correlation of lipid profile with body mass index in young adults (18-20 years)

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Article History:

Received on: 10 Nov 2019
Revised on: 12 Dec 2019
Accepted on: 30 Dec 2019

Keywords:

Body Mass Index,
Low-density lipoprotein,
High-density lipoproteins,
Very low-density lipoproteins

ABSTRACT

Overweight and obesity in youth is a worldwide public health problem. Predisposition to obesity starts during the first or second decade of life. 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 mellitus. Our study was done to find the relation between body mass index (BMI) and lipid profile in young adults (18-20 years) and for the correlation between the various parameters. 150 young adults between 18-20 years of age, who gave written voluntary consent were included in the study. BMI was calculated after measuring height and weight along with fasting blood samples for estimation of blood glucose and lipid profile [total cholesterol, High-density lipoprotein (HDL), Low-density lipoprotein (LDL), Very low-density lipoprotein (VLDL) and triacylglycerol (TGL)] were measured. A linear correlation regression analysis was done to know the correlation between the anthropometric measurements and biochemical parameters. All the biochemical parameters showed a positive correlation with BMI. Total cholesterol had the highest positive correlation with BMI. There was a prevalence of 39.3% overweight/obesity as per BMI cut-off. Individuals who were in the obese category had a higher prevalence of abnormal lipid profiles, especially total cholesterol. Stress and lack of physical activity have a detrimental effect on health and are a major risk factor for the development of obesity. 90% of the students in this study did not have any regular physical activity. Educating the students about the effects of obesity and dyslipidaemia on the quality of health can help in bringing lifestyle modifications that can help them in the long run.

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ISSN: 0975-7538

DOI: https://doi.org/10.26452/ijrps.v11iSPL2.2137

Production and Hosted by

IJRPS | www.ijrps.com

INTRODUCTION

The different population has 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 (Mathias *et al.*, 2009).

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

Table 1: Male students parameters (n=68)

Parameter	Minimum	Maximum	Mean	Std. Deviation
BMI(kg/m^2)	15	34	22.01	3.614
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/m^2)	15	34	21.89	3.583
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
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

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

Table 5: Correlation between BMI and other parameters

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

Valuesare expressed as mean ± SEM *p<0.05 – Significant, **p<0.01-Highlysignificant, ***p<0.001-Extremely significant

such as metabolic syndrome, early atherosclerosis, dyslipidaemia, hypertension, and type 2 diabetes mellitus (Ferraro *et al.*, 2003).

It is important to find the correlation between anthropometric measurements, lipid profile and glycaemic levels in a medical population, especially the first-year medical students, because they are exposed to mental stress and lack of physical activity during their 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.

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 (Singh *et al.*, 2008).

Aims and Objectives

To measure the Body mass index

To estimate Fasting blood glucose and lipid profile.

To compare Fasting blood glucose, lipid profile with BMI.

MATERIALS AND METHODS

Sample Size

150 young adults in the age group of 18-20 years.

Selection of subjects

The participants in the age group of 18-20 years 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 young adults who gave written voluntary consent to participate in the study were instructed to come in the morning by 8.00 AM after an overnight fasting of 10-12 hours to the Department of Biochemistry. 3ml of the venous blood sample was collected from each student after confirming that they were on a 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.

BMI Measurement

Height was measured to the nearest 0.1cm, while the subject was standing in an erect position, barefoot 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 motionless, 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 (m^2). (Cole *et al.*, 2007) The cut-off values for obesity were more than 95^{th} percentile in adolescents and over-weight was greater than or equal to 85^{th} percentile (Cole *et al.*, 2007).

Following investigations were done in the Clinical Biochemistry laboratory

Fasting blood glucose was measured by the Enzymatic Glucose oxidase – peroxidase method. (Bishop Clinical Chemistry 6^{th} edition)

Serum Total Cholesterol was measured by Enzymatic Cholesterol oxidase – peroxidase method. (Bishop Clinical Chemistry 6^{th} edition)

Serum Triacylglycerol was measured by the enzymatic colorimetric method. (Bishop Clinical Chemistry 6^{th} edition)

Serum HDL-Cholesterol was measured by the Precipitation method. (Bishop Clinical Chemistry 6^{th} edition)

LDL and VLDL-Cholesterol were estimated using Friedwald's formula. (Bishop Clinical Chemistry 6^{th} edition)

RESULTS AND DISCUSSION

The data collected was entered into an excel sheet (Microsoft office excel, 2016). A total of 150 young adults participated in the study, of which 82 were females and 68 were males. The data were analyzed 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. Tables 1 and 2 show 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.

Cut-offs for BMI were applied to categorize them into underweight, normal, overweight and obese.

According to the cut-off for BMI, the prevalence of overweight and obese was 38.2% in males and 40.2% in females. The overall prevalence was 39.3%. Table 4 shows the number of students, along with the percentage prevalence falling in the respective categories for males and females.

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

Correlation between BMI and lipid profile

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, 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.

This study was conducted to know the influence of BMI on lipid profile and fasting blood glucose and the correlation between individual parameters in medical students.

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 (Misra and Vikram, 2003).

Anthropometric cut-offs (Tandon *et al.*, 2013), when applied to the current study group, yielded a prevalence of 18% overweight (BMI 23-24.9 kg/m^2) and 21.3% obese (BMI > 25kg/m^2).

All the parameters of the lipid profile had a positive correlation with BMI. BMI had the strongest association with Total cholesterol (R-value +0.847). Individuals with BMI > 23kg/m^2 had higher total, LDL, VLDL and triglycerides than individuals with BMI < 23kg/m^2. The mean total, LDL, VLDL and triglycerides were significantly high in the overweight group (BMI > 23 kg/m^2).

HDL was almost the same in obese and non-obese groups, irrespective of the BMI. BMI had a significant association (p-value > 0.001) with all the parameters except HDL. HDL in this group was within the normal range. This might be because of the age of the study population as all of them are in the young age group 18-20 years and similar findings were reported by (Novaes *et al.*, 2007).

Individuals who were in the obese category had a higher prevalence of abnormal lipid profiles, especially Total cholesterol. Results of the European fat distribution study (Seidell *et al.*, 1991) and Paris prospective study (Filipovsky *et al.*, 1993) established a 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, higher serum triglycerides and higher blood glucose than lean persons. (Krauss *et al.*, 1998) Our study also had similar findings with respect to total cholesterol and BMI.

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 and low HDL are the most important cardiovascular risk factors. (Blumenthal *et al.*, 2011) INTERHEART study reported that a high ratio of apo-A to apo-B is a more important lipid risk factor in South Asian subjects (Karthikeyan *et al.*, 2009). 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. As all the individuals of this study were in the age of 18-20 years, 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 (Carr and Brunzell, 2004; Kim and Reaven, 2008; Boden *et al.*, 2001).

Obesity, especially during childhood and adolescence, has a long-term impact on all the systems (Lobstein *et al.*, 2004) and leads to the development of the metabolic syndrome (Vanhala *et al.*, 1998).

Approximately 75% of urban adolescents and young adults were recently reported to be sedentary. 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 (Grøntved *et al.*, 2013). India is in a "second stage" of epidemiologic transition, accumulating a high burden of non-communicable diseases (Yusuf *et al.*, 2001).

This study has shown a prevalence of 39.3% overweight/obesity. Various studies have shown a prevalence of 5-50% of obesity in adolescents (Misra *et al.*, 2004; Vikram *et al.*, 2006).

CONCLUSION

Stress and lack of physical activity have a detrimental effect on health and are a major risk factor for the 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, 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. Educating the students about the effects of obesity and dyslipidaemia on the quality of health can help in bringing about lifestyle modifications that can help them in the long run.

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