ORIGINAL RESEARCH PAPER

Biochemistry

ASSOCIATION OF BODY MASS INDEX WITH LIPID PROFILE AMONG MEDICAL STUDENTS

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ABSTRACT

BACKGROUND: Prevalence of overweight-obesity is rising in India. Medical Professionals are vulnerable to overweight-obesity because of the sedentary lifestyle which is frequently adopted due to massive work burden.

METHODS: This Cross Sectional, Observational Study was done in the Department of Biochemistry, RNT Medical College, Udaipur. 300 medical students were selected via simple random sampling.

RESULTS: Among study population 10.6% subjects were overweight at risk, 19.6% were obese 1 and 11.5% were under obese 2 category. The present study showed a significant increase in serum level of total cholesterol and HDL in females subjects in comparison to the male subjects of the study population. We found that higher BMI was directly associated with total cholesterol (P Value <0.001), triglycerides (P Value 0.012), HDL-C (P Value <0.001), LDL-C (P Value <0.001) and VLDL-C (P Value 0.013).

CONCLUSION: High prevalence of cardiovascular risk factors like overweight and deranged Lipid Profile was common among medical students. So, it can be concluded that healthy lifestyle should be adopted from young adulthood since medical students are the future health providers.

INTRODUCTION

Overweight and obesity are well recognized as "escalating epidemic" in both developed and developing countries (Beaglehole R et al. 2003 and Bertsias G et al. 2003). Obesity in children and adolescents is gradually becoming a major public health problem in India (Bhave S et al. 2004). Five percent of total population of India has been affected by obesity (Dobbelsteyn C et al. 2001).

Lipids and lipoproteins are well known risk factors for ischemic heart disease. Elevated levels of triglyceride, cholesterol and LDL-C are documented as risk factors for atherogenesis (Lipid Research Clinic Program, 1984).

In recent years, BMI has become the medical standard used to measure over weight and obesity. There is limited published data about the association of body mass index (BMI) with lipid profile among healthy medical students especially with reference to Southern Rajasthan.

Overweight and obesity are defined by World Health Organization (WHO) as "abnormal or excessive fat accumulation that presents risks to health" (WHO 2018). A significant rise in prevalence of obesity affecting both men and women is seen in the last three decades worldwide (Ng M, Fleming T et al. 2013). Similar trends have been observed in India. ICMR INDIAB phase I study carried out among adult population of states of Tamil Nadu, Maharashtra, Jharkhand, and Union Territory of Chandigarh found prevalence of obesity between 11.8 to 31.3% and prevalence of abdominal obesity between 16.9 to 36.1 percent (Pradeepa R et al. 2015). People from younger age groups have also been affected. About one-fifth of Indian children and adolescents are either overweight or obese (Ranjani H et al. 2016). Medical profession is synonymous with long duty hours, erratic food timings and exposure to a host of stressful situations which put medical students at risk to develop lifestyle associated disorders including overweight and obesity. Studies from central and south India have shown 9.4% to 38 % prevalence of overweight-obesity among M.B.B.S. students Jayaraj et al.

2014; Kamath S et al. 2014; Singru S et al. 2014; Tiwari R et al. 2014; Gudegowda KS et al. 2018; Lakshmi Y et al. 2015 and Vidyapeeth S et al. 2015). However, dietary habits and patterns of physical activity differ across the country. A study from Southern Rajasthan will enrich the existing data on problem of overweight-obesity in medical students.

AIM & OBJECTIVE:

This study was planned to determine the relationship between serum lipids to obesity parameter in medical students.

METERIAL AND METHOD:

The present cross sectional institution based study was conducted on 300 healthy students of RNT Medical College, Udaipur.

Inclusion criteria for the study are as follows:-
- Eligible participants were medical students (I, II and III year MBBS students).
- Both sexes.

Exclusion criteria included those with:-
- Non willing for participation.
- Any acute or chronic illness.
- Malabsorption syndrome.
- Previously diagnosed with diabetes, hypertension or dyslipidemia with and without treatment.

Institutional ethical committee approval was taken and written consent was taken from Each and every student.

Collection of Blood Samples: 5 ml of fasting blood sample was drawn from antecubital vein. The collected sample was incubated at 37°C for 15 minutes in the incubator and then centrifuged for 10 minutes at approximately 3000rpm. Total Cholesterol, triglyceride, HDL-C and LDL-C were estimated.

(a) Analysis Of Blood Parameters For Various Analytical Parameters:
1. Total Cholesterol : Cholesterol Oxidase Peroxidase

(Stadtman TC., 1957)

2. **Triglyceride:** Enzymatic method (Burtis CA, 1994)
3. **High Density Lipoprotein Cholesterol (HDL-C):** Homogenous method Acelerator Selective Detergent Methodology (Rifai N, 1997)
4. **Low Density Lipoprotein Cholesterol (LDL-C):** Beta-quantification determination of LDL-C concentration (NCEP: Adult Treatment Panel III, 2002)
5. **Very Low Density Lipoprotein Cholesterol (VLDL-C):** (Friedewald, 1972) VLDL Cholesterol = Triglyecrides/5

Biological Reference Range:
- **Total Cholesterol:** Desirable <200 mg/dl; Borderline High 200-239 mg/dl; High ≥ 240mg/dl.
- **Triglyceride:** Normal < 150 mg/dl; Borderline high 150-199 mg/dl; High 200-499 mg/dl; Very High ≥ 500 mg/dl
- **HDL-C:** The National Cholesterol Education Program Adult Treatment Panel III (NCEP- ATP III) provides the following classification of HDL-C

Concentrations:
- HDL < 40 mg/dl (Low HDL cholesterol)
- HDL ≥ 60 mg/dl (High HDL cholesterol)
- **LDL-C:** Optimal < 100mg/dl; Near Optimal 100-129 mg/dl; Borderline High 130-159 mg/dl; High 160- 189 mg/dl; Very High > 190 mg/dl.
- **VLDL-C:** 0-35 mg/dl.

(b) Anthopometric Study:
Body Mass Index (BMI): (WHO/IASO/IOTF 2000)
Body Mass Index (BMI) is a value derived from the mass (Weight) and height of a person. The BMI is a defined as the body mass divided by the square of the body height, and is universally expressed in units of Kg/m².

$$BMI\ (Kg/m^2) = Weight/Height$$

BMI Classification

Classification	BMI (Kg/m²)
Underweight	< 18.5
Normal range	18.5-22.9
Overweight at risk	23-24.9
Obese I	25-29.9
Obese II	≥ 30

STATISTICAL ANALYSIS:
All parameters were given as mean± standard deviation (SD).

The comparisons between the groups were analyzed by Student's t-test and ANOVA. The criterion for significance was $p < 0.05$. Data analysis was performed with the statistical package for the social sciences version 17.00.

RESULTS
Out of 300 students, males were 219 and females were 81. Out of 300 students, 273 were residing in hostels whereas 27 were day scholars.

Mean serum total cholesterol in students was 239.177 ± 53.0432 mg/dl, triglycerides 184.06 ± 42.037 mg/dl, HDL 45.26 ± 8.646 mg/dl, LDL 141.10 ± 29.582 mg/dl and mean VLDL was 36.812 ± 8.407 mg/dl (Table 1)

Table 1: Lipid Profile values of the subjects

Lipid Profile	N	Mean	SD	Minimum	Maximum
Total Cholesterol	300	239.177	53.0432	128.0	450.0
Triglycerides	300	184.06	42.037	107	353
HDL	300	45.26	8.646	23	90
LDL	300	141.10	29.582	45	200
VLDL	300	36.812	8.4074	21.4	70.6

When intra group comparison of the lipid profile was done, the mean and SD of serum total cholesterol in male students was 228.2 ± 42.0 mg/dl and female students was 268.8± 66.95 mg/dl with P Value < 0.001, considered statistically significant, triglycerides in male students was 183.3 ± 43.1 mg/dl and female students was 186.2 ± 39.05 mg/dl, HDL-C in male students was 44.3 ± 7.8 mg/dl and female students was 48.0 ± 10.16 mg/dl which was statistically significant (P Value 0.001). LDL- C in male students was 139.3 ± 30.9 mg/dl and female students was 146.1 ± 25.21 mg/dl and VLDL-C male students was 36.7± 8.6 mg/dl and female students was 37.2 ± 7.81 mg/dl (Table 2).
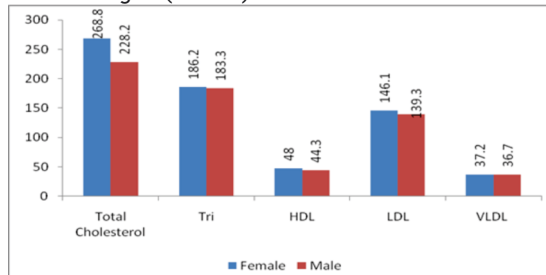

Figure 1: Lipid Profile values (mg/dl) of males and females

Table 2: Lipid Profile values of males and females

Gender Lipid Profile	Female			Male			Total			"t" value	P Value
	Mean	N	SD	Mean	N	SD	Mean	N	SD		
Total Cholesterol	268.8	81	66.95	228.2	219	42.0	239.2	300	53.0	6.249	<0.001
Tri	186.2	81	39.05	183.3	219	43.1	184.1	300	42.0	0.547	0.58
HDL	48.0	81	10.16	44.3	219	7.8	45.3	300	8.6	3.361	0.001
LDL	146.1	81	25.21	139.3	219	30.9	141.1	300	29.6	1.773	0.077
VLDL	37.2	81	7.81	36.7	219	8.6	36.8	300	8.4	0.517	0.58

With regard to BMI, 51 were underweight (BMI 17.50± 0.64). 148 Were normal weight (BMI 20.67 ± 1.27), 30 were overweight at risk (BMI 23.96 ± 0.55), 49 were obese 1 (BMI 27.13 ± 1.54) and 22 were obese 2 (BMI 35.29 ± 4.87). (Table3).

Table 3: Body Mass Index (BMI) of the subjects

BMI	Mean	SD	N	% of Total Sum	F statistics	P value
under weight	17.5067	0.64456	51	13.2%	541.66	<0.001
normal	20.6705	1.27767	148	45.1%		
overweight at risk	23.9658	0.55243	30	10.6%		
obese 1	27.1349	1.54195	49	19.6%		
obese 2	35.2903	4.87285	22	11.5%		
Total	22.5901	4.96238	300	100.0%		

Table 4: Comparison of Lipid Profile with BMI groups

BMI	under weight			normal			overweight at risk			obese 1			obese 2			Total				
	Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD	F value	P Value

Total Cholesterol	213.3	51	45.9	221.6	148	38.8	232.4	30	46	246.7	49	45.7	246.7	22	58.4	239	300	53	5.681	<0.001
Triglyceride	169.6	51	35.2	175.1	148	43.6	179.9	30	34.5	189.8	49	44.1	199.5	22	46.3	184	300	42	3.257	0.012
HDL	48	51	7.4	46.5	148	9	44.2	30	9.5	41.2	49	6	41.5	22	8.6	45.3	300	8.6	6.327	<0.001
LDL	124.3	51	32.5	139.5	148	31.7	151.5	30	24.4	141.3	49	20.9	150.5	22	27.6	141	300	30	5.613	<0.001
VLDL	33.9	51	7	35	148	8.7	36	30	6.9	38	49	8.8	39.9	22	9.3	36.8	300	8.4	3.191	0.013

Comparison of the BMI groups with regard to serum total cholesterol, triglycerides, HDL-C, LDL-C and VLDL-C were examined. We found significant difference in serum total cholesterol (P Value <0.001), triglycerides (P Value 0.012), HDL-C (P Value <0.001), LDL-C (P Value <0.001) and VLDL-C (P Value 0.013) in BMI groups (Table4).

DISCUSSION

The present study showed a significant increase in serum level of total cholesterol and HDL in females subjects in comparison to the male subjects of the study population. Similar results were obtained in a study done by Tarig A. Marhoum *et al.* 2013 showed HDL-cholesterol was significantly less in males (M±SD = 45.2±13.76 mg/dl) compared to females (M±SD = 51.8±14.9 mg/dl, *P*= 0.032).

In another study done by Dr.Balasim Rasheed Habeeb Alquraishi ,Eman Rababah 2016 which include 96 students of age group 18-31yrs showed that the mean total concentration of cholesterol, LDL-c and Non HDL (mg/dl) in males (165.88±32.20, 85.00±39.94, 105.09±34.22) respectively is less than in females (194.27±52.04, 125.32±50.39, 139.14±51.35) correspondingly. The mean total concentration of HDL-c and TG (61.97±13.29, 94.80±53.65) respectively are higher in male than those in female (54.57±13.14, 71.75±35.51) correspondingly.

In the present study out of 300 subjects 10.6% were overweight at risk, 19.6% were obese 1 and 11.5% were under obese 2 category.

The prevalence of overweight-obesity in India has doubled in last one decade according to the national family health surveys. (SCIENCES IIFP. National family health survey -4 India, Ministry of health and family welfare) Overweight-obesity is slowly spreading its roots across all ages and sections of our society. The noble profession of Medicine demands absolute dedication and a lot of hard work from its professionals often at the cost of ignoring their own health. These professionals remain at risk of developing lifestyle related disorders including overweight-obesity.

The possible reasons for higher prevalence of overweight-obesity in present study could be (i) difference in dietary habits, (ii) distinct patterns and opportunities to engage in physical activity, and (iii) different socio-demographic profile.

Earlier studies from central and southern parts of India have shown prevalence of overweight-obese among medical students ranging from 9.4%-37.5%. Jayara *et al.* 2014, Kamath S *et al.* 2013, Singru S *et al.* 2014, Tiwari R *et al.* 2014, Gudegowda KS *et al.* 2018, Lakshmi Y *et al.* 2015, Vidyapeeth S *et al.* 2015 and Selvaraj K *et al.* 2013.

We found that higher BMI was directly associated with total cholesterol (P Value <0.001), triglycerides (P Value 0.012), HDL-C (P Value <0.001), LDL-C (P Value <0.001) and VLDL-C (P Value 0.013).

Different researchers in their studies have shown an association between BMI and lipid profile, and also the association between lipid profile and body fat distribution had been much discussed during the past few decades, both lipid profile and body fat have been shown to be the important predictors for metabolic disturbances including dyslipidemia, hypertension and various chronic diseases like diabetes, cardiovascular diseases, hyperinsulinaemia etc. Sandhu *HS et al.* 2008.

Al-Agha et al (2019 conducted a study to assess the relationship between lipid profile components among different body mass index (BMI) groups. They included 218 children and adolescents of which 104 were males and 114 were females. It was found that 10.6% of subjects were overweight; 22.1% had obesity, out of which 7.1% were morbidly obese.

It was further observed that children who had high levels of low-density lipoprotein (LDL) and low levels of high-density lipoprotein (HDL) had higher BMI groups, with elevated cholesterol levels noted in patients of increased weight. 71% of the children had increase in HDL levels who avoided fast-food consumption. There was no significant correlation of BMI and gender.

Being overweight or obese can lead to adverse metabolic effects on, cholesterol and triglycerides. Free fatty acids (FFA) are released in abundance from adipose tissue mass. As a consequence, FFA increases the liver production of TG and secretion of VLDL. Hypertriglyceridaemia and VLDL reduce HDL cholesterol. Circulating FFA, may contribute to the induction of hypertension Ugwuja EI *et al.* 2013.

CONCLUSION

As overweight, obesity and hyperlipidaemia along with a high BMI serve as good indicators in recognizing cases at high risk that might progress to cardiovascular and metabolic disorders in later period of life. All the students were given advice regarding healthy lifestyle practices.

Hence by conducting educational programs, regarding healthy lifestyle, recreational activities, yoga meditation and providing good and nutritious food in the campus canteen and follow up of students with lifestyle disorders would be beneficial.

Healthy lifestyles should be adopted from young adulthood itself as these medical students are pillars of future Nation.

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