To Study The Correlation of Body Mass Index With Serum Cholesterol Level In Youth

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Introduction: Body mass index has been associated with changes in serum cholesterol levels. Aim of our study was to determine the serum cholesterol in the youth of Surat city and to associate it with the body mass index (BMI). Method: This cross-sectional study was done among 100 healthy subjects aged 15-24 years. By using enzymatic method TC was estimated and TC ≥ 200 mg/dl was defined as hypercholesterolemia as per WHO/IASO/IOTF (2000). All cases are classified into BMI categories. The range of TC found in the study groups was 124-220 mg/dl. Result: The results indicate that mean cholesterol level in males and females were 140-200 mg/dl and 139-192 mg/dl respectively. Prevalence of hypercholesterolemia was 16% in the study group. We found positive correlation of TC and BMI in males ($r = 0.63$, $p<0.05$) and in females ($r = 0.66$, $p< 0.66$). Conclusion: So, we conclude that the youths who are overweight should advise routine cholesterol checkup. So preventive measures can be adopted to avoid it's complications in future.[Kruti P NJIRM 2017; 8(4):85-90]

Key Words: Body mass index, Hypercholesterolemia

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Introduction: Persistent health inequalities are a worldwide problem. It is time for developing countries like India, to review and reset their health priorities. A prominent example is that of cardiovascular disease (CVD). More importantly, the disease catches Indian young population. [1] Coronary artery disease (CAD) occurring in less than 45 years of age is termed as young CAD. Projection suggests that by 2015, 62 million Indians will have CAD, out of which 23 million are expected to be below 40 years. [2] Cardiovascular risk factors start early, track through the young age and manifest in middle age in most societies. Currently, most adults (> or =56%) are overweight, approximately 1 in 5 is obese. Abdominal obesity (assessed indirectly by measuring waist circumference) may be associated with cardiovascular and metabolic risk factors (i.e;hypertriglyceridemia, low high-density lipoprotein (HDL) cholesterol levels, high blood pressure, and elevated levels of fasting glucose) known as the metabolic syndrome.[3]The serum cholesterol level is a strong predictor of clinically evident cardiovascular diseases in healthy young adults.[4] The risk of developing CAD and premature atherosclerosis increases, as the level of serum cholesterol rises. The serum Cholesterol level depends on many factors like, Hereditary factors play the greatest role; but it also depends on dietary habits, environmental factors, age, sex and physical activity.[5, 6]Aim of this study was to determine the serum cholesterol level and to find any correlation of the serum cholesterol level of the subjects with their body mass index (BMI) in youth of Surat city, Gujarat.

Method: This study was conducted in Dept. of Physiology, Govt. Medical College, Surat. Approval of the study was taken from the research and ethical committees of the institute. The study comprised of a total of 100 apparently healthy subjects (75 males and 25 females) aged 15-24 years. Local youths, were chosen as subjects. The cases were selected randomly during the period of August 2016 to January 2017. The study was cross-sectional in nature with adequate statistical analysis. Subjects having major diseases like diabetes mellitus, hypertension, coronary artery disease, endocrine diseases, or those taking any lipid altering medication were excluded from the study group. Personal history and medical history was collected in pre-designed Performa and Written informed consent was obtained from all the subjects. General examination, anthropometric measurements and systemic examination were done.

Method of measuring serum cholesterol: Serum cholesterol was determined by using enzymatic calorimetric method (CHOD-PAP).[7, 8] After 12-14 hours fasting blood sample was taken by venipuncture in all the subjects for serum cholesterol estimation. Using a centrifuge machine serum was separated and within 4 hrs of sample collection, estimation of serum total cholesterol was done manually in the biochemistry laboratory with the help of Cholesterol kit from (Transasia bio-medicals ltd.Baddi, Dist- Solan) and Digital Photo colorimeter from (Transasia bio-medicals ltd.). The desirable cholesterol range in adults is < 200 mg/dl. Serum cholesterol ≥ 200 was categorized as hypercholesterolemia.[9]

Method of measuring BMI: The height of the subjects (bare-footed) was measured in meters with a standard Anthropometer and weight was measured in kilogram using a weighing machine.

BMI was calculated using the WHO formula: BMI = weight (in kg)/height^2 (in m^2).

The subjects were classified into different categories of BMI as per the WHO/IASO/IOTF (2000) recommendation for Asian adults. Recommendations for overweight is defined as a BMI ≥ 23 and obesity as a BMI ≥ 25 is a risk factor for cardiovascular diseases in case of Asian population.[10]

Statistical analysis: The analysis were done usingMicrosoft Office Excel 2007 and SPSS statistics 17.0 software and Student's t-test was done to analyze the quantitative data and to determine the p value. Values are expressed as mean ± SD. The probability level for significance was set at *P*< 0.05. Pearson's correlation coefficient was employed to determine the correlation between BMI and TC level.

Results: Table 1 shows comparative data of anthropometric measures including, age (in years), height (in meters) weight (in kg), BMI (kg/ m^2), waist circumference (in cm) in youth (N = 100= 75 males + 25 females) from the age group of 15 – 24 years.

Table I: Anthropometric characteristics of the study group.

Parameter (n=100)	Mean	SD
Mean Age (in years)	20.46	2.91
Mean Height (in meters)	1.668	0.09
Mean Weight (in kg)	73.19	11.29
Mean BMI (kg/m2)	22.46	2.55
Mean WC (in cm)	85.19	8.01

[BMI: Body mass index; WC: Waist-circumference; n: number of cases.]

Figure 1: Comparison of Anthropometric characteristics in males and females of the study group:

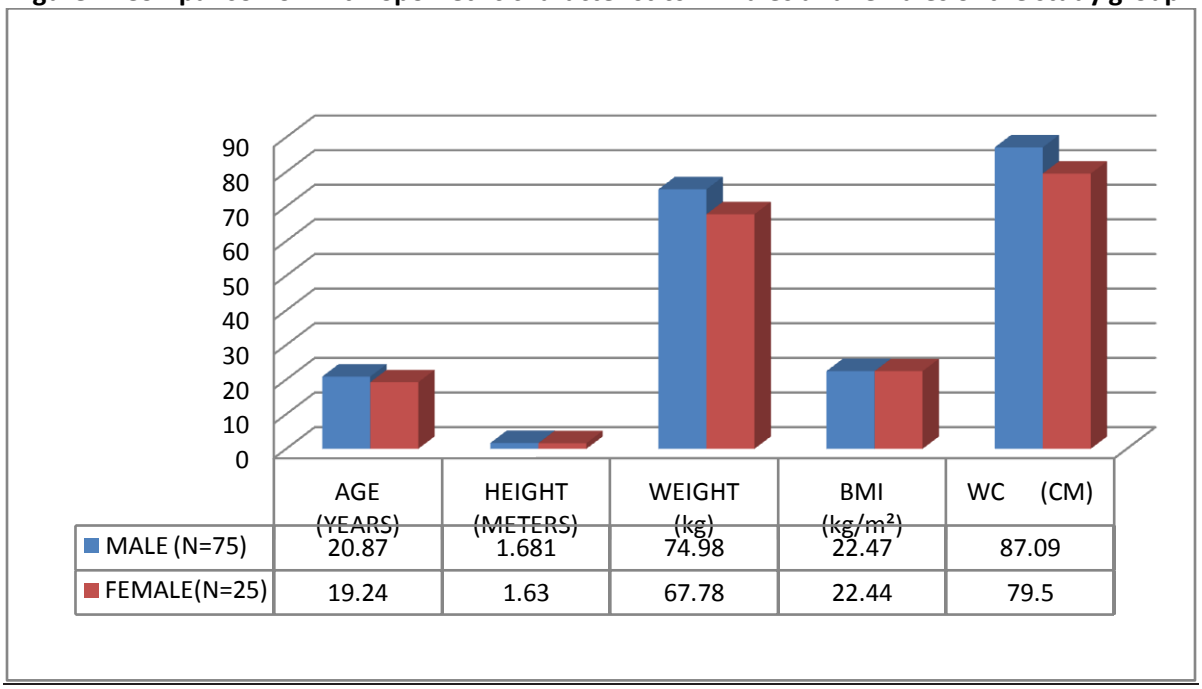
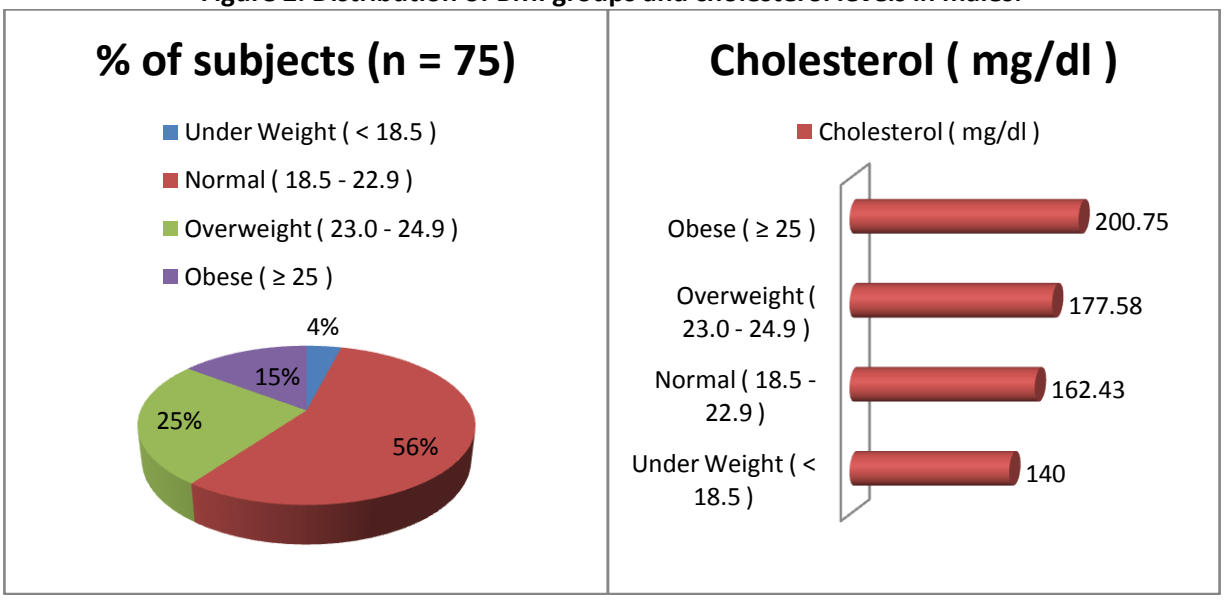


Table II: Variations of mean cholesterol level (in mg/dl) with different groups of BMI in males.

BMI groups	No. of Participants (n = 75)	% of Participants	Cholesterol (mg / dl)	P Value
Underweight (<18.5)	3	4	140 ± 16.50	<0.05
Normal (18.5-22.9)	42	56	162.43 ± 12.25	
Overweight (23.0-24.9)	19	25.33	177.58 ± 16.05	
Obese (≥25)	11	14.66	200.75 ± 5.9	

BMI = Basal Metabolic Rate

Figure 2: Distribution of BMI groups and cholesterol levels in males:



The variation of mean cholesterol level with BMI in males: From Table II, it is seen that mean TC level in underweight BMI category is 140 mg / dl in males which is increased to 200 mg/dL at the highest category of BMI.

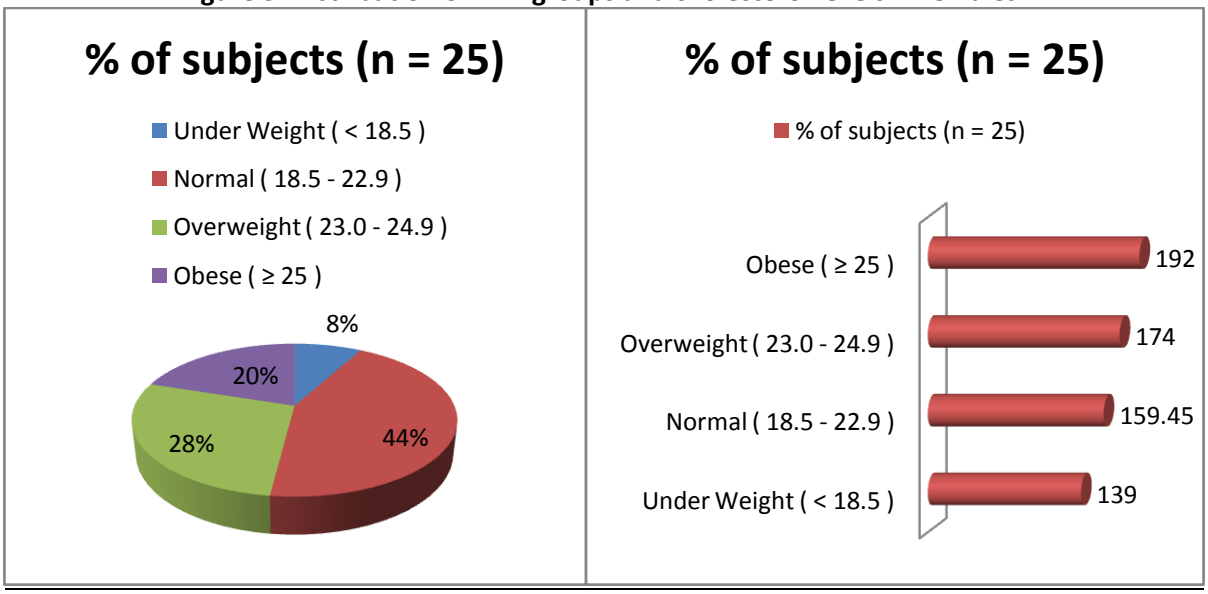
Table III: Variation of mean cholesterol level (in mg/dl) with different groups of BMI in females.

BMI groups	No. of Participants (n = 25)	% of Participants	Cholesterol (mg / dl)	P Value
Underweight (<18.5)	2	8	139 ± 9.10	<0.05
Normal (18.5-22.9)	11	44	159.45 ± 21.36	
Overweight (23.0-24.9)	7	28	174.0 ± 17.94	
Obese (≥25)	5	20	192.0 ± 19.43	

BMI = Basal Metabolic Rate

The variation of mean cholesterol level with BMI in females: From Table III, it is seen that among females, mean TC level increased from 139 mg/dL at the lowest BMI category to 192 mg/dL at the highest BMI level.

Figure 3: Distribution of BMI groups and cholesterol levels in females:



The range of serum cholesterol level in youth was (124-220) mg/dl. The mean cholesterol level in males and females were 171.47 ± 20.33 mg / dl and 167.88 ± 23.40 mg/dlrespectively. Out of 100 cases, 88% cases had cholesterol level < 200 mg/dl and 12% cases had hypercholesterolemia, i.e. ≥ 200 mg/dl. Out of 100 cases 5% were underweight, 53% cases had normal weight, 26% cases were overweight, and 16% were obese.

Statistical analysis: There are four different BMI categories are presented in Table II and III, which are Underweight (<18.5), Normal (18.5-22.9), Overweight (23.0-24.9), and Obese (≥25) in both males and females. The mean cholesterol values of normal weight group were compared with that of overweight group. Unpaired t-test was performed to find the p-value. Significant differences was noted between the two categories ($p<0.05$). Similarly, the mean cholesterol values of normal weight cases were compared with that of obese group and, significant differences was noted between the two categories ($p<0.05$). Pearson's correlation coefficient (r) was calculated to find the correlation between TC and BMI. The correlation coefficient was found to be 0.63, ($p< 0.05$) in male and in female it was 0.66($p < 0.05$).

Discussion: In today's society lack of physical activity has caused low levels of fitness and increases incidence of various health related problems such as cardiovascular diseases. Overweight and obesity are the most common nutritional disorders and this has heightened our concern towards the strong association between obesity and cardiovascular morbidity.[10] Present study was designed to explore the relationship of serum cholesterol with BMI in youth. The study was conducted on 100 healthy participants which was based on estimation of serum cholesterol and obesity was measured using BMI.

In this study the range of total serum cholesterol is124–220mg/dl. In males it is 124-220 mg/dl and in females it is 141-199 mg/dl. A study done by Mdhumita Das and Mauchumi Saikia showed that the total serum cholesterol level in males was (98-206mg/dl) and females (93-239mg/dl) in the age group of 21-30 years.[11] Our results show higher results of serum cholesterol as compared to this study. A study done by S. Padmavati et al;on dietary fat, serum cholesterol levels and incidence of atherosclerosis in Delhi. Results of this study was 174 mg/dl total serum cholesterol level.[12]

Prospective study shows the minor decrease in cholesterol level by diet and proper exercise, which will decrease the risk of CAD.[13] Total cholesterol level level was positively associated with ischemic heart disease in middle aged peoples. In our study the prevalence of hypercholesterolemia is 16% which is significant because of young age of participants who led a stressful and sedentary lifestyle. Results shown by Stamler et al., were same as our study.[14] A study done by Soumithra Nath and Washima Jahan in Asam, the total cholesterol was significantly correlated with BMI and WC, with 7% of cases had hypercholesterolemia. Some young adults have positive genetic correlation with premature CAD.[15]

The increasing prevalence of obesity is a major health problem worldwide in young adult's obesity has been recognized as a potential risk factor for CVD, diabetes mellitus and cancer on the other hand abdominal fat distribution is a strong risk factor for CVD and BMI may not indicate the level of central adiposity. At present WC is recommended as measure for abdominal obesity. Some studies show that there is independent effect of WC on CVD. While direct assessment of fat mass may be a better index of obesity-related health risk, it is difficult to measure this accurately in the field setting. Thus, anthropometry still remains the most widely used method for clinical and epidemiological purposes. In this study, 16% of the participants are obese when classified according to BMI.

In contrast to this study Esmaillzdeh et al. Concluded that WHpR is a better predictor for cardiovascular risk factors than BMI, WC and WHtR in Tehranian adult men.[16] In this study, a strong correlation was found between serum cholesterol and BMI. Results of a study done by Tanu midha et al. showed that BMI and waist circumference can be used as a screening tool for hypertension.[17] Ishikawa-takata et al also suggested that the risks for hypertension and hypercholesterolemia were strongly associated with weight gain in a Japanese male population who showed a low prevalence of severe obesity.[18] Saely CH et al. suggested that prevalence rates of excess bodyweight and of elevated blood pressure are high in young Swiss men, and these entities are strongly interrelated. Excess body weight and high blood

pressure are independently associated with high serum cholesterol in this population. Excess bodyweight and associated risk factors should receive increased attention in young Swiss men.[19] A study done by Zaher ZM et al shows that,Waist circumference may be a better indicator for the prediction of obesity-related cardiovascular risk factors in men and women compared to BMI.[20]A combination of BMI and central obesity measures was found to be associated with risk of CVD than either of them alone in both sexes.[21]

Hypercholesterolemia and obesity have been proved to be individual risk factors for cardiovascular diseases and increased value of BMI may increase the risk of hypercholesterolemia. Youth is the age of transition from adolescence to young adulthood where, in parallel to changes in working and social status, alterations in lifestyle typically occur. So, young individuals aged around 20 years are important group to study the cardiovascular risk factors. Simple anthropometric measurements such as BMI and waist circumference can be used for screening people at increased risk of hypertension in order to refer them for more careful and early diagnostic evaluation. Policies and programs are required for primary and secondary prevention of hypertension.

Conclusion: In conclusion, the results of present study indicate that, the serum cholesterol level is increased in overweight youths. The range of serum cholesterol in the present study was 124-220 mg/dl. The range of cholesterol in males and females were 140-200 mg/dl and 139-192 mg/dl respectively and 16% of subjects had hypercholesterolemia and 86% of total subjects had a normal range of the serum cholesterol. Young adults (15–24 year olds) are prone to overweight and obesity during the transition from adolescence to adult in developing countries like India. Using convenient low cost measures like BMI and WC to assess body fat might be useful to identify obesity in young adults, which is especially important to counter the risk of metabolic imbalances in later life. Culturally acceptable interventions based on evidence need to be developed and evaluated. In turn these will inform future policy makers to help plan effective strategies to prevent obesity among young people and to adopt healthy lifestyle to avoid hypercholesterolemia and obesity in future.

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