



ANALYSIS OF SERUM CHOLESTEROL LEVELS AND ITS ASSOCIATION WITH BMI AND WC IN YOUNG ADULTS

Physiology

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ABSTRACT

Aim: To analyze the serum cholesterol levels (TC) in young adults of aged 20 – 30 years and also to evaluate the association of TC with Body mass index (BMI) and waist circumference (WC).

Methodology: 200 young participants were enrolled for this cross sectional study. TC was estimated by drawing the blood of the participants by venipuncture using an enzymatic method. BMI and WC were measured and calculated.

Results: Mean cholesterol levels in males and females were found to be 166 ± 12.34 mg/dl and 173 ± 13.21 mg/dl respectively. TC was found to be significantly associated with the BMI and WC (p value < 0.001 and p value < 0.01 respectively). A strong correlation was found between TC and BMI and TC and WC.

Conclusion: BMI and WC are very strong predictors of TC and could identify the risk of cardiovascular disease later in life.

KEYWORDS

Waist circumference, body mass index, serum cholesterol.

Introduction:

Excess body weight is a known risk factor which lead to cardiovascular diseases, type 2 diabetes and increased early mortality.^{1,2} The rate of coronary artery diseases is highest in Indians and is prone to CAD at a much younger age than anywhere in the world.³ The serum cholesterol is a strong predictor of the cardiovascular diseases as the risk of cardiovascular disease and atherosclerosis rises with the increasing levels of cholesterol.⁴ There are many factors which decide the serum cholesterol levels like hereditary factors, dietary habits, age, sex and physical activity and lifestyle. Thus serum cholesterol level varies from population to population.⁵

Body mass index (BMI) is one of the most commonly used indicator of obesity and could be directly associated with the parameters of lipid profile.^{6,7} Body mass index is commonly used in clinical settings to approximate the body fat and to assess the risk in adults.⁸ Waist circumference (WC) is found to be the strong predictor of the obesity related risk factors in adults.⁹

The finding of varying serum cholesterol levels in different populations has been investigated. But very limited information are been concluded in this respect. The present study aimed to analyze the serum cholesterol levels and its association with body mass index and waist circumference in young adults.

Methodology:

A total of 200 young healthy adults of aged 20 – 30 years were enrolled in the study out of which 120 were males and remaining 80 were females. The participants were selected based on random sampling.

Inclusion criteria:

1. Young adults from 20 – 30 years who are systemically healthy
2. The participants who agreed to be a part of the study

Exclusion criteria:

1. Participants with diseases like hypertension, diabetes mellitus, cardiovascular disease, metabolic diseases
2. Participants who had a history of receiving any lipid alteration medications

Written informed consents are signed by each of the participants. This cross sectional study was in accordance with the ethical standards on the committee on human experimentation of the institution. The anthropometric measurements are recorded from each of the patient.

Measurement of serum cholesterol (TC):

Fasting blood of 12 – 14 hours is taken by venipuncture from all the participants for estimating serum cholesterol. Serum is separated by

centrifugation of the blood. Cholesterol kit (Crest biosystem) is used for manual assessment of serum cholesterol. Enzymatic method (CHOD-PAP)¹⁰ is used for the estimation of serum cholesterol. The normal range for serum cholesterol is below 200 mg/dl. Serum cholesterol more than 200 mg/dl is considered hypercholesterolemia.¹¹

BMI measurement:

Height of all the participants was measured in meters and body weight is measured using a weighing machine in kilograms. Then the calculation of body mass index is done which is calculated by the WHO formula:

$$\text{BMI} = \text{Weight (Kg)} / \text{height}^2 (\text{m}^2)$$

Waist circumference (WC) measurement:

Waist circumference is measured using a flexible measuring tape by measuring the circumference at the midway between the lowest rib and iliac crest while allowing the participant to breathe silently at the end of the expiration. The measurements are done in centimeters to the nearest 0.1 cm. The participants were classified into different categories of BMI and WC according to the WHO (2000) criteria.

Statistical Analysis:

Data were tabulated and examined using the Statistical Package for Social Sciences Version 20.0 (IBM SPSS Statistics for Mac, Armonk, NY: IBM Corp, USA). Descriptive statistical analysis had been carried out in the present study. P-value of < 0.05 was considered as significant. Pearson's correlation test was used to correlate the association of BMI and TC and WC and TC.

Results:

A total of 200 participants (120 males and 80 females) were recruited for the study that aged between 20 – 30 years. Among the study population 92 % of the participants had TC levels below 200 mg/dl and remaining 8% had TC levels higher than 200 mg/dl (table 1).

In males, the underweight, normal, overweight and obese participants had 146 ± 1.8 , 162.2 ± 6.1 , 171.2 ± 5.6 and 190.8 ± 3.2 respectively. In females, the underweight, normal, overweight and obese participants had 147 ± 1.4 , 162.4 ± 5.8 , 176.4 ± 5.2 and 194.2 ± 3.9 respectively. These variations show the increasing TC levels with the increasing BMI level (Table 2).

In the present study, 95 males had WC less than 90 cm and 25 males had WC more than 90cm. The TC levels of males with less than 90 cm were 167.1 ± 3.2 mg/dl and with more than 90 cm was 199 ± 4.1 mg/dl. Thus, 20% of the male study population has obesity related issues. The TC levels in females with WC less than 80 cm was 164.7 ± 8.4 mg/dl

and 188 ± 7.6 mg/dl respectively. Thus, 37.5 % females were found to be obese (Table 3).

Discussion:

The present study had revealed the range of serum cholesterol in the healthy population as 148 – 217 mg/dl. Das et al¹² in their study had found the range of TC varying from 98 – 206 mg/dl in males and 93 – 236mg/dl in females. In the present study the range of TC levels were found to be higher than in the previous studies.

The present study depicted that 8% of the study population had hypercholesterolemia. Stamler et al.¹³ has revealed that elevated cholesterol levels are strongly positively correlated with the cardiovascular diseases. Early detection of cholesterol levels could allow for early interventions by cholesterol lowering medications. Clarke et al¹⁴ have revealed that even moderate reduction in cholesterol levels could substantially reduce the risk of CAD.

Because of the sedentary lifestyle, obesity has become a serious health issue in present times. BMI and WC are the strong predictors for assessment of overweight or obese individual in the field settings. In the present study population 20% males and 37.5 % females were found to be obese according to the WC anthropometric measurements. According to BMI 16.5% study population were found to be obese.

Saely et al.¹⁵ have revealed the similar results and found that serum cholesterol is directly correlated with the increasing categories of BMI.

In the present study a strong positive correlation has been established between TC levels with BMI and WC. Henceforth, it could be concluded that the risk of hypercholesterolemia could be higher in individuals with higher BMI and WC measurements.

This study could suggest that the age group 20 -30 is crucial as the lifestyle changes typically occur at this age because of the working and social status changes. Early interventions for reducing weight would be surely effective in decreasing the risk of cardiovascular diseases later in life.

Conclusion:

BMI and WC are strong predictors of the total cholesterol levels in the serum which can be easily measured and calculated routinely. These predictors can strongly estimate the increasing risk of cardiovascular diseases later in life. Early diagnosis at an early age would be beneficial to take precautions and early intervention to reduce the risk of cardiovascular diseases. Especially young adults should adopt a healthy lifestyle to avoid the risk of obesity and hypercholesterolemia.

Table 1: Anthropometric measurements of the study population

Variables	Male (n=120)	Female (n=80)
Age (years)	23 $\pm$ 3.58	24 $\pm$ 4.84
Height (m)	1.69 $\pm$ 0.05	1.61 $\pm$ 0.08
Weight (Kg)	66 $\pm$ 11.02	61 $\pm$ 9.13
BMI (Kg/m ²)	23.01 $\pm$ 9.46	22.78 $\pm$ 8.79
WC (cm)	83.54 $\pm$ 4.02	81.43 $\pm$ 5.23

BMI: Body mass index, WC: Waist circumference

Table 2: Variation in serum cholesterol levels (TC) in various categories of BMI

Variables	BMI categories				P value
	Under weight	Normal	Over weight	Obese	
Males	3	61	34	22	<0.001*
No of case	146 $\pm$ 1.8	162.2 $\pm$ 6.1	171.2 $\pm$ 5.6	190.8 $\pm$ 3.2	
TC levels (mg/dl)					
Females	3	48	19	10	<0.001*
No of case	147 $\pm$ 1.4	162.4 $\pm$ 5.8	176.4 $\pm$ 5.2	194.2 $\pm$ 3.9	
TC level (mg/dl)					
Total	6	109	53	33	0.001*
No of case	146 $\pm$ 1.6	162.5 $\pm$ 6.4	173.5 $\pm$ 4.9	192.4 $\pm$ 4.1	
TC levels(mg/dl)					

*P value < 0.05 is significant

Table 3: Association with WC and TC levels in men and women

WC	Men		P value
	No of cases	TC levels (mg/dl)	
<90 cm	95	167.1 $\pm$ 3.2	<0.01
>90 cm	25	199 $\pm$ 4.1	
	Women		
	No of cases	TC levels (mg/dl)	
<80 cm	50	164.7 $\pm$ 8.4	<0.01
>80 cm	30	188 $\pm$ 7.6	

*P value < 0.05 is significant

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