Research Article

Evaluation of variation in the lipid profile and risk for coronary artery disease in healthy male individuals with respect to age

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ABSTRACT

Background: Coronary Artery Disease (CAD) is one of the commonest causes of death affecting both sexes worldwide. It is the leading cause of mortality in developed countries. The measurement of lipids, lipoproteins and apolipoproteins has long been recognized as necessary for the diagnosis and clinical management of disorders of lipoprotein metabolism. On the basis of this, the present study was performed to compare the serum lipid profile in males of different age groups.

Methods: The present cross-sectional study was conducted after the institutional ethical clearance. The male subjects between the ages of 20-59 were included in the study. Blood was collected from the subjects after an overnight fast of 12 hours who were also advised to refrain from non-vegetarian food for 3 days. Estimation of serum total cholesterol was done by using the cholesterol kit which uses modified Allain's method for estimating serum cholesterol. Serum triglyceride was estimated using the triglyceride kit which is based on GPO-POD method. Estimation of serum HDL cholesterol was done using cholesterol kit which uses modified Allain's method. Serum LDL cholesterol level was calculated using the Friedewald's formula, LDL cholesterol = Total cholesterol - (HDL-C + TG/5). Estimation of fasting blood sugar was done using GOD-POD method. The lipid levels with risk for CAD were performed based on Framingham heart study. Statistical analysis was done by unpaired t-test for group wise comparison and P value <0.05 was considered statistically significant.

Results: The lipid levels on comparison in 2 successive age groups of males, that is 20-29 and 30-39 years; and 30-39 and 40-49years; 40-49 and 50-59 years, it was found that the mean values of total cholesterol, triglyceride, LDL-C and the ratio of TC/HDL-C and LDL-C/HDL-C are increased while HDL-C is decreased in the older age group.

Conclusion: From the present study it is understood that as age advances total cholesterol, LDL-C & triglyceride increases; ratios between TC/HDL-C and LDL-C/HDL-C also increases. But HDL-C shows a decrease in males. The risk for CAD with respect to lipid values is higher in older age groups.

Keywords: Lipid profile, Coronary artery diseases, TC/HDL-C ratio and LDL-C/HDL-C ratio

INTRODUCTION

The measurement of lipids, lipoproteins and apolipoproteins has long been recognized as necessary for the diagnosis and clinical management of disorders of lipoprotein metabolism. The discovery of ultra-centrifugation technique was a major step in the study of lipoproteins.[1] Variations of lipids in men and women are influenced by puberty, pregnancy and menopause. Both endogenous and exogenous sex hormones seem to affect plasma lipoprotein metabolism and in turn influence atherosclerosis and coronary artery diseases. Estrogen lowers the level of lipoprotein-a. The lipid lowering effect of estrogen replacement therapy accounts for about 25% of the cardio protective effects in postmenopausal

women. Lipid levels may be affected by diet, obesity, exercise, stress, smoking, alcohol, certain medication like Beta Blockers, Thiazide diuretics, glucocorticoids and concurrent disease states like diabetes, kidney and liver diseases, hypothyroidism etc. Lipid levels are also elevated in different familial hyperlipidemias.

Diet has a role in altering the lipid levels. Diet rich in saturated fatty acids like butterfat, beef fat, coconut oil increase blood lipid levels. Sucrose and fructose have a greater effect in raising blood lipids, particularly triglycerides than do other carbohydrates. Polyunsaturated and monounsaturated fatty acids lower blood cholesterol level.[2]

Saturated fats raise serum total cholesterol and polyunsaturated fats cause it to decrease. Relatively low total cholesterol and LDL-C is also seen in populations consuming monosaturated fats. Regular moderate consumption of alcohol increases serum HDL-C. Caloric excess is the commonest cause of hypertriglyceridemia. Cholesterol levels are increased by eating too much saturated dietary fat and calories.[3] Transfatty acids which are produced by catalytic hydrogenation of polyunsaturated fats result in solidification of fats. These fats have an LDL-C and triglyceride elevating effects as well as an effect in reducing HDL-C. Reduction of trans fatty acids reduce cholesterol concentration.[4]

Epidemiological studies have demonstrated the importance of the relationship between excess saturated fat consumption and elevated cholesterol levels. The role of hypercholesterolemia in atherogenesis gave rise to the almost universally accepted cholesterol-diet-CHD hypothesis. The cholesterol-diet-CHD hypothesis states that elevated plasma cholesterol levels cause CAD and diet rich in saturated fat raise cholesterol levels and that lowering cholesterol level reduces CAD risk. Reducing the consumption of dietary saturated fat and cholesterol is the cornerstone of population based approaches to the management of hypercholesterolemia.[5] Hyperlipidemia is an important factor for atherosclerosis and hence, control of blood lipid level stands first in the prevention of vascular atherosclerosis. On the basis of these observations this study was performed to compare the serum lipid profile in males of different age groups.

METHODS

The present cross-sectional study was conducted at govt. medical college Kottayam after the institutional ethical clearance. The data and blood samples were collected from the bystanders of the patients admitted in different wards randomly after getting the informed and written consent from all the participants. The male subjects between the ages of 20-59 were included in the study. Whereas, the subjects with the history of diabetes, hypertension, endocrine disease, medication such as contraceptive, beta blockers, diuretics, steroids and anticonvulsant, chronic smokers, chronic alcoholics and

persons having debilitating illness were excluded from the study.

Blood was collected from the subjects after an overnight fast of 12 hours who were also advised to refrain from non-vegetarian food for 3 days. Disposable syringes and needles were used to collect blood samples. Under all aseptic precaution 6 ml of blood sample was drawn from antecubital vein. Out of which 5 ml was collected into a dried plain bottle and 1 ml for estimating fasting blood sugar into a dried bottle which contained EDTA.

Serum was taken and centrifuged to remove fibrin and residual cells. Estimation of lipid profile was done using the kit provided by Dr. Reddy's laboratories and estimation of fasting blood sugar was done using Eco-pak provided by Accurex biomedical private limited. All readings were taken using a semi auto analyzer. The parameters like sample volume, wavelength of the filter, temperature etc. can be programmed by the user. The instrument aspirates the mixture of the reagent and sample by using a peristaltic pump and measures the optical density while it is passed into a flow cell curette. The instrument requires a very low volume of sample and the readings have high precision.

Estimation of serum total cholesterol was done by using the cholesterol kit which uses modified Allain's method for estimating serum cholesterol. Serum triglyceride was estimated using the triglyceride kit which is based on GPO-POD method. Estimation of serum HDL cholesterol was done using cholesterol kit which uses modified Allain's method. Serum LDL cholesterol level was calculated using the Friedewald's formula, LDL cholesterol = Total cholesterol - (HDL-C + TG/5). Estimation of fasting blood sugar was done using GOD-POD method.

The lipid levels with risk for CAD were performed based on Framingham heart study.

Statistical analysis

Data were expressed as mean ± SD. The mean values of all the parameters of lipid profile tests were analyzed using the statistical software SPSS (version 17). Unpaired t-test was used for group wise comparison and P value <0.05 was considered statistically significant.

RESULTS

The present study compares the variation in the circulating levels of total cholesterol, triglyceride, LDL-cholesterol, HDL-Cholesterol, TC/HDL-C ratio and LDL-C/HDL-C ratio in males of different age groups.

on comparison of lipid profile in males of the age group 20-29 & 30-39, it is seen that the mean values of total cholesterol, triglycerides and LDL-C are higher in the 30-39 age group compared to 20-29 age group. But the

means value of HDL-C is lower in the 30-39 age group. The variation of means values between the two age groups is statistically significant for total cholesterol & LDL-C. The means values of TC/HDL-C ratio and LDL-C/HDL-C ratio are higher in the 30-39 age groups and the difference in values is statistically significant (Table 1).

Table 1: Comparison of lipid profile of males in the age group of 20-29 & 30-39 years. N=40 in each group.

Parameters	Age group (years)	Mean ± SD	P value
Total cholesterol	20-29	177.1 ± 17.6	0.015 Sig
	30-39	190 ± 22.1	
Triglyceride	20-29	99.6 ± 21.2	0.084 NS
	30-39	109.9 ± 24.3	
LDL cholesterol	20-29	105.7 ± 18.1	0.006 Sig
	30-39	118.8 ± 17.6	
HDL Cholesterol	20-29	51.5 ± 7.3	0.207 NS
	30-39	49.3 ± 5.7	
TC/HDL-C	20-29	3.5 ± 0.65	0.022 Sig
	30-39	3.9 ± 0.56	
LDL-C/HDL-C	20-29	2.1 ± 0.59	0.025 Sig
	30-39	2.4 ± 0.46	

Note: Sig = statistically significant, NS = non-significant

Comparison of lipid profile in males of the age group 30-39 & 40-49 showed that the mean values of total cholesterol. LDL-C and triglycerides are higher in the 40-49 age group compared to 30-39 age groups. But the mean value of HDL-C is lower in the 40-49 age groups. On statistical analysis the difference in values between the two age groups was not significant with respect to all parameters. The mean values of TC/HDL-C ratio and LDL-C/HDL-C ratio are higher in the 40-49 age group and difference in the ratio's are significant statistically (Table 2).

Table 2: Comparison of lipid profile of males in the age group of 30-39 & 40-49 years. N=40 in each group.

Parameters	Age group (years)	Mean ± SD	P value
Total cholesterol	30-39	190 ± 22.1	0.344 NS
	40-39	195.4 ± 21.7	
Triglyceride	30-39	109.9 ± 24.3	0.139 NS
	40-39	119.8 ± 26.5	
LDL cholesterol	30-39	118.8 ± 17.6	0.065 NS
	40-39	127.2 ± 17.0	
HDL Cholesterol	30-39	49.3 ± 5.7	0.139 NS
	40-39	47 ± 6.1	
TC/HDL-C	30-39	3.9 ± 0.56	0.009 Sig
	40-39	4.2 ± 0.42	
LDL-C/HDL-C	30-39	2.4 ± 0.47	0.011 Sig
	40-39	2.4 ± 0.46	

Note: Sig = statistically significant, NS = non-significant

On comparison of lipid profile in males of the age group 40-49 ad 50-59 it is seen that the mean values of total cholesterol, LDL-C and triglycerides are higher in the 50-59 age group compared to the 40-49 age group. But the mean value of HDL-C is lower in the 50-59 age group. When statistically analyzed the difference in the value of HDL-C and LDL-C is significant and that of total cholesterol and triglyceride is not significant (Table-3). The mean values of TC/HDL-C ratio and LDL-C/HDL-C ratio are higher in the 50-59 age group, and the difference in the ratio's are significant statistically (Table 3).

Table 3: Comparison of lipid profile of males in the age group 40-49 and 50-59 years. N=40 in each group.

Parameters	Age group (years)	Mean ± SD	P value
Total cholesterol	40-49	195.4 ± 21.7	0.685 NS
	50-59	197.8 ± 23.3	
Triglyceride	40-49	119.8 ± 26.5	0.615 NS
	50-59	123.3 ± 27.2	
LDL cholesterol	40-49	127.2 ± 17.0	0.001 Sig
	50-59	146 ± 23.5	
HDL Cholesterol	40-49	47 ± 6.1	0.027 Sig
	50-59	43.5 ± 5.8	
TC/HDL-C	40-49	4.2 ± 0.42	0.000 HS
	50-59	4.9 ± 0.51	
LDL-C/HDL-C	40-49	2.7 ± 0.37	0.000 HS
	50-59	3.4 ± 0.45	

Note: Sig = statistically significant, NS = non-significant, HS = highly significant

Table 4: Comparison of lipid profile of males in the age group 20-29 and 40-49 years. N=40 in each group.

Parameters	Age group (years)	Mean ± SD	P value
Total cholesterol	20-29	177.1 ± 17.6	0.001 Sig
	40-49	195.4 ± 21.7	
Triglyceride	20-29	99.6 ± 21.2	0.002 Sig
	40-49	119.8 ± 26.5	
LDL cholesterol	20-29	105.7 ± 18.1	0.000 HS
	40-49	127.2 ± 17	
HDL Cholesterol	20-29	51.5 ± 7.3	0.013 Sig
	40-49	47 ± 6.1	
TC/HDL-C	20-29	3.5 ± 0.65	0.000 HS
	40-49	4.2 ± 0.42	
LDL-C/HDL-C	20-29	2.1 ± 0.59	0.000 HS
	40-49	2.7 ± 0.37	

Note: Sig = statistically significant, HS = highly significant

Comparison of lipid profile in males of the age group 20-29 and 40-49 shows that the mean values of total cholesterol, LDC-C and triglyceride are higher in the 40-49 age group compared to the 20-29 age group. But the mean value of HDL-C is lower in the 40-49 age groups.

When statistically analyzed the difference in the values was found to be significant with respect to all parameters. Mean values of TC/HDL-C ratio and LDL-C/HDL-C ratio are higher in the 40-49 age groups and difference is found to be statistically significant (Table 4).

Table 5: Comparison of lipid profile of males in the age group 30-39 and 50-59 years. N=40 in each group.

Parameters	Age group (years)	Mean ± SD	P value
Total cholesterol	30-39	190 ± 22.1	0.190 NS
	50-59	197.8 ± 23.3	
Triglyceride	30-39	109.9 ± 24.3	0.050 Sig
	50-59	123.3 ± 27.2	
LDL cholesterol	30-39	118.8 ± 17.6	0.000 HS
	50-59	146 ± 23.5	
HDL Cholesterol	30-39	49.3 ± 5.7	0.000 HS
	50-59	43.5 ± 5.8	
TC/HDL-C	30-39	3.9 ± 0.56	0.000 HS
	50-59	4.9 ± 0.51	
LDL-C/HDL-C	30-39	2.4 ± 0.47	0.000 HS
	50-59	3.4 ± 0.45	

Note: Sig = statistically significant, NS = non-significant, HS = highly significant

On comparison of lipid profile in males of the age group 30-39 and 50-59 it is seen that the mean values of total cholesterol, LDL-C and triglycerides are higher in the 50-59 age group compared to the age group 30-39. But the mean value of HDL-C is lower in the 50-59 age groups. When statistically analyzed the difference in values of all the parameters between the two age groups was significant except for total cholesterol. The mean value of TC/HDL-C ratio and LDL-C/HDL-C ratio are also higher in the 50-59 age groups. And the difference in the ratios is found to be significant statistically (Table 5).

Table 6: Comparison of lipid profile of males in the age group 20-29 and 50-59 years. N=40 in each group.

Parameters	Age group (years)	Mean ± SD	P value
Total cholesterol	20-29	177.1 ± 17.6	0.000 HS
	50-59	197.8 ± 23.3	
Triglyceride	20-29	99.6 ± 21.2	0.000 HS
	50-59	123.3 ± 27.2	
LDL cholesterol	20-29	105.7 ± 18.1	0.000 HS
	50-59	146 ± 23.5	
HDL Cholesterol	20-29	51.5 ± 7.3	0.000 HS
	50-59	43.5 ± 5.8	
TC/HDL-C	20-29	3.5 ± 0.65	0.000 HS
	50-59	4.9 ± 0.51	
LDL-C/HDL-C	20-29	2.1 ± 0.59	0.000 HS
	50-59	3.4 ± 0.45	

Note: HS = highly significant

Comparison of lipid profile in males of the age group 20-29 at 50-59 shows that the mean values of total cholesterol LDL-C and triglycerides are higher in the 50-59 age group compared to the 20-29 age group. But the mean value of HDL-C is lower in the 50-59 age groups. And when the difference in values between the two age groups were analyzed statistically is significant with respect to all parameters. The mean values of TC/HDL-C & LDL-C/HDL-C ratio are higher in the 50-59 age groups and when statistically analyzed the difference in the ratios is significant (Table 6).

In males assessing the risk based on total cholesterol values, 9 subjects in the 50-59 age group but only 2 subject in 20-29 age groups have moderate to high risk for CAD (Table 7). 9 subjects in 50-59 age groups and one subject in the 20-29 age groups are at moderate to high risk for CAD (Table 8) based on triglyceride.

3 subjects in 50-59 age group but none in 20-29 age groups have high to very high risk for CAD (Table 9) based on LDL-C values. Based on HDL-C, 4 subjects in 50-59 age group and none in 20-29 age groups have high risk for CAD (Table 10). The ratios showed a different pattern. 30 subjects in the 50-59 age group and 15 subjects in the age group 20-29 are at high risk with respect to TC/HDL-C ratio (Table 11). Similarly 30 subjects in 50-59 age group and 17 subjects in 20-29 age group are at moderate to high risk for CAD (Table 12).

Table 7: Risk for coronary artery disease based on total cholesterol in males.

Value based risk		Number of subjects			
Risk	Value (mg/dl)	Age groups			
		20-29	30-39	40-49	50-59
Very low	<160	5	1	0	0
Low	160-199	23	25	24	21
Moderate	200-239	2	2	4	8
High	240-279	0	2	1	1
Very high	≥280	0	0	1	0
Total		30	30	30	30

Table 8: Risk for coronary artery disease based on triglyceride in males.

Value based risk		Number of subjects			
Risk	Value (mg/dl)	Age groups			
		20-29	30-39	40-49	50-59
Low	<150	29	26	23	21
Moderate	150-199	1	4	7	8
High	200-499	0	0	0	1
Very high	≥500	0	0	0	0
Total		30	30	30	30

Table 9: Risk for coronary artery disease based on LDL cholesterol in males.

Value based risk		Number of subjects			
Risk	Value (mg/dl)	Age groups			
		20-29	30-39	40-49	50-59
Very low	<100	11	25	25	5
Low	100-129	18	3	2	19
Moderate	130-159	1	2	3	3
High	160-190	0	0	0	3
Very high	≥190	0	0	0	0
Total		30	30	30	30

Table 10: Risk for coronary artery disease based on HDL cholesterol in males.

Value based risk		Number of subjects			
Risk	Value (mg/dl)	Age groups			
		20-29	30-39	40-49	50-59
High	<40	0	0	5	4
Moderate	40-49	3	7	9	20
Low	50-59	15	14	16	6
Very low	≥60	12	9	0	0
Total		30	30	30	30

Table 11: Risk for coronary artery disease based on TC/HDL cholesterol in males.

Value based risk		Number of subjects			
Risk	Value (mg/dl)	Age groups			
		20-29	30-39	40-49	50-59
High	>3.5	15	22	9	30
Low	≤3.5	15	8	1	0
Total		30	30	30	30

Table 12: Risk for coronary artery disease based on LDL-C/HDL-C ratio in males.

Value based risk		Number of subjects			
Risk	Value (mg/dl)	Age groups			
		20-29	30-39	40-49	50-59
Low	<2	13	6	0	0
Moderate	2-5	17	24	30	30
High	>5	0	0	0	0
Total		30	30	30	30

DISCUSSION

In the present study, upon comparison of the lipid levels in 2 successive age groups of males, that is 20-29 and 30-39 years; and 30-39 and 40-49 years; 40-49 and 50-59 years, it was found that the mean values of total cholesterol, triglyceride, LDL-C and the ratio of TC/HDL-C and LDL-C/HDL-C are increased while HDL-C is decreased in the older age group. But the difference is not found to be statistically significant with respect to most values. When the mean values of total cholesterol, triglyceride, LDL-C,HDL-C and the ratio's

of TC/HDL-C and LDL-C/HDL-C was compared between the age groups 20-29 and 40-49; 30-39 and 50-59; 20-29 and 50-59, it showed an increase for all values except HDL-C, which is decreased in older age group and the difference was found to be statistically significant for most of the values. This showed that, in males, as age advances all the lipids except HDL-C increases. This finding is similar to the study by Gupta et al. in 1997.[6]

It was reported by Gupta et al. in 1994[7] that, age relates positively with total cholesterol, LDL-C and triglyceride levels in both sexes. Levels of serum cholesterol, LDL-C, triglyceride and the ratios of TC/HDL-C and LDL-C/HDL-C are directly related with the risk of CAD,[8] while HDL-C correlates inversely with the risk of CAD.[9]

According to Framingham heart study, the risk for CAD based on lipids is as follows.

Table 13: The risk for CAD according to Framingham heart study.

Risk for CAD	
Risk based on cholesterol levels in mg %	
Very low	<160
Low	160-199
Moderate	200-239
High	240-279
Very high	≥280
Risk based on triglyceride levels in mg%	
Low	<150
Moderate	150-199
High	200-499
Very high	≥500
Risk based on LDL-C levels in mg%	
Very low	<100
Low	100-129
Moderate	130-159
High	160-190
Very high	≥190
Risk based on HDL-C in mg%	
High	<40 in males
Low	50-59
Very low	≥60
Risk based on TC/HDL-C	
High	>3.5
Low	≤3.5
Risk based on LDL-C/HDL-C	
Low	<2
Moderate	2-5
High	>5

Analysis of the present study showed that risk for CAD is more in older age group than younger. Subjects of advanced age group have higher values of lipid profile and are more prone for CAD. According to the Framingham heart study 1949-1979 risk for atherosclerosis is increased with an increase in the serum

cholesterol and triglyceride levels. Various studies showed a strong positive association between atherosclerosis and LDL-C[10-12] and the levels, of LDL-C are more closely associated with CAD.[9] LDL particle must undergo oxidative modification before they become pathogenic. The oxidized LDL molecules lead to endothelial cell or vessel wall dysfunction which is associated with the development of atherosclerosis. It was proved that elevated levels of HDL-C are predictive of protection from atherosclerotic cardiovascular disease.[13] It was also emphasized that total cholesterol; LDL-C and triglyceride have a positive relation with atherosclerosis. HDL-C transports free cholesterol from blood to liver, thus removing free cholesterol from circulation, so that cholesterol deposition inside the walls of blood vessels is minimized.[13,14] The ratio of TC/HDL-C is powerful discriminators for the presence and severity of CAD risk.[15] These ratios have been widely used as atherogenic indices. As age has influence on lipid levels, serial estimation of lipid followed by control of level by drug can prevent development of CAD.

CONCLUSION

From the present study it is understood that as age advances total cholesterol, LDL-C & triglyceride increases; ratios between TC/HDL-C and LDL-C/HDL-C also increases. But HDL-C shows a decrease in males. The risk for CAD with respect to lipid values is higher in older age groups.F

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