Original Article

Prevalence of Dyslipidemia and Associated Factors in a Rural Population in North Kerala

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Abstract

Background: An imbalance in blood lipids called dyslipidaemia leads to arterial inflammation and plaque development. Changes in lipid levels can be brought on by a number of conditions, including obesity, liver and chronic renal disease, smoking, steroids, alcoholism, diabetes mellitus, and alcohol misuse.

Methods: This cross-sectional study was conducted from December 2023 to June 2024 in Puzhakkattiri panchayat with a sample size of 599 selected using purposive sampling. Factors affecting the outcome variables was assessed using chi-square test and Fisher Exact test. Correlation between the continuous variables was calculated using Pearson correlation.

Results: Prevalence of dyslipidaemia was found to be 60.1%. Age group is statistically significant with altered total cholesterol, triglycerides and HDL levels. In this study, the levels of total cholesterol and triglyceride were higher among females as compared to men. Higher blood lipid levels are seen in patients having higher BMI and high waist to hip ratio. Triglycerides and HDL levels were found to be significantly associated with Hypertension and diabetic status of the patient.

Conclusion: The study reveals that hypercholesterolemia is prevalent in rural Kerala, with age group, gender, obesity, hypertension, diabetes significantly affecting total cholesterol, triglycerides, and HDL levels. Reducing modifiable risk factors and promoting diet and physical exercise can help to control diabetes and hypertension.

Keywords: Prevalence of dyslipidaemia, associated factors, North Kerala.

Introduction

Dyslipidemia is a broad term which refers to an imbalance of blood lipids. It may be either high level of low-density lipoprotein cholesterol (LDL - C) or triglycerides (TG) which causes the plaque formation and arterial inflammation or low level of high-density lipoprotein cholesterol

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(HDL C)[1]. Dyslipidaemia usually does not cause any symptoms, but often co-exist with HOD syndrome (Hypertension, Obesity and Dyslipidaemia) and increases the risk of cardiovascular disease and stroke. Hypercholesterolemia is a modifiable risk factor causing 18% of global cerebrovascular diseases, 56% of ischemic heart diseases resulting in 4.4 million deaths annually. One third of ischaemic heart disease in the world is attributable to high cholesterol. Overall, raised cholesterol is estimated to cause 2.6 million (4.5% of total) deaths and 29.7 million Disability Adjusted Life Years (2% of total DALYS).[2].

The risk of coronary heart disease increases with increase in plasma cholesterol concentration. A diet containing more energy than needed may lead to prolonged post prandial hyperlipidemia and to deposition of triglycerides in adipose tissue resulting in obesity.[3] In 2008, the global prevalence of raised total cholesterol among adults was 39% (37% for males and 40% for females).[4]

Among other non-communicable diseases, prevalence of dyslipidaemias was found to be 81.2% in India[5]. Recent studies report that hypercholesterolemia is present in 25–30% of urban and 15–20% of rural population. The most common dyslipidemia in India are borderline high LDL cholesterol and low HDL cholesterol and high triglycerides.[6] Keralites have the highest cholesterol level in India that ranges from 197 to 229mg/dl compared to 157 to 180mg/dl nationally which is attributable to the high intake of saturated fat from coconut, meat, milk, and oil.[7]

Regional disparity was observed with higher prevalence of hypercholesterolemia in northern states and hypertriglyceridemia in southern states. Low HDL-C was the most common lipid abnormality (72.3%).[7]

MN Krishnan et al found that most risk factors of CAD were highly prevalent in the state and included overweight or obesity in 59 %, abdominal obesity in 57 %, hypertension in 28.4 %, diabetes in 15.2 %, high total cholesterol in 52.3 % and low level of high-densitylipoprotein (HDLcholesterol in 39 %.[8] The Tamilnadu based study by Ajay S also observed a similar burden of dyslipidemiaamong rural and urban areas. Study also highlighted the linear association of Age and BMIwith dyslipidemia[9].

There are no studies done in Malappuram district assessing the risk factors for dyslipidaemia and the factors affecting it. Knowledge on prevalence of dyslipidaemia in the field practice area of MES Medical College will help to plan an appropriate intervention here.

The aim of the study was to determine the prevalence of dyslipidemia and the factors associated with dyslipidemia among the adult population more than 18 years of age residing in Puzhakkattiri Panchayat.

Methodology

This cross-sectional study was conducted in Puzhakkattiri panchayat from December 2023 to June 2024 among all the adult population who were residing here for at least 6 months and consented to participate in the study. Those who were not able to apprehend the questions were excluded from the study. Sample size was calculated by the formula Z^2 PQ / d^2. In a previous study, the prevalence of dyslipidemia was found to be 63.8%.[1]. The sample size calculated was 580. We have included 591 participants in this study. Purposive sampling method was used to collect the data. Hypercholesterolemia is diagnosed if fasting cholesterol value ≥240. Patient is diagnosed to have hypertrigleceridemia if the fasting triglyceride level ≥200. LDL levels is high if the fasting LDL level ≥190. HDL level is considered to be low if the level ≤40. Asian classification was used to categorise the BMI. Patient is said to be overweight if the BMI ≥ 23.5kg/ m^2Normal waist to hip ratio is less than 0.9 for males and less than 0.85 for females. Hypertension was classified according to JNC 8 criteria. Puzhakkaattiri Panchayat is the field practice area of MES Medical College, Perinthalmanna. Houses were selected by conducting a health checkup camp. General physical examination of the participants was conducted including, measurements of Blood pressure, weight, height, waist, hip. Fasting Blood samples were collected to examine their lipid profile. Demographic details also were collectedusing a questionnaire.

Data Analysis

Microsoft Excel was used for data entry. A statistical analysis software package (SPSS version 26) was used to analyse the data. Normality of data was checked using Kolmogorov Smirnov test and appropriate parametric or non-parametric test was applied. For qualitative data chi-square test or Fisher exact test was used to find out the significant difference in groups. Pearson correlation test was used to find the correlation between the quantitative variables.

Results

Table no.1 Showing the baseline characteristics of study participants.

Sl No	Variables	Frequency	Percentage
1	**Age group**		
	19-29	82	13.9
	30-39	119	20.1
	40-49	138	23.4
	50-59	104	17.6
	60-69	87	14.7
	>70	61	10.3
2	**Gender**		
	Male	223	37.7
	Female	368	62.3
3	**Marital Status**		
	Unmarried	43	7.3
	Married	474	80.2
	Legally divorced	2	.3
	Separated	9	1.5
	Widow/widower	63	10.7
4	**Religion**		
	Hindu	144	24.4
	Islam	447	75.6
5	**Educational Status**		
	Illiterate	49	8.3
	Primary school	95	16.1
	Middle school	115	19.5
	High school	214	36.2
	Degree	105	17.8
6	**Occupational Status**		
	Clerical/Shop/ Farm	32	5.4
	Semi-professional	21	3.6
	Semiskilled worker	40	6.8
	Skilled worker	28	4.7
	Student	37	6.3
	Unemployed	345	58.4
	Unskilled worker	88	14.9
7	**Hypercholesterolemia**		
	No	236	39.9
	Yes	355	60.1
8	**Hypertriglyceridemia**		
	No	377	63.8
	Yes	214	36.2
9	**HDL category**		
	0-40	181	30.6
	41-50	207	35.0
	>50	203	34.3
10	**LDL category**		
	Normal	252	42.6
	High	339	57.4
11	**Hypertension**		
	Normal	280	47.4
	Hypertensive	311	52.6
12	**Waist hip ratio male**		
	Normal	19	8.5
	High	204	91.5
13	**Waist hip ratio female**		
	Normal	39	10.6
	High	329	89.4
14	**Waist hip ratio**		
	Normal	58	9.8
	High	533	90.2
15	**Body mass index (BMI)**		
	Overweight and above	339	61.2
	Normal and below	215	38.8

Prevalence of dyslipidaemia/ hypercholesterolemia was found to be 60.1 % among the study participants. Hypertriglyceridemia present in 36.2 % of the people. 35% of the people had HDL levels between 41-50, while 34.5 % had HDL level more than 50 mg/dL. Among the study participants 52.6 % had hypertension. The overall normal Waist to hip ratio (WHR) among the study participants was

9.8% (8.5% in males, 10.6% in females). BMI among the study participants was seen normal in 38.8% where the remaining 61.22% were either overweight or obese.

Table no 6. showing association between age group and the Lipid profile of the study participants

Sl No	Lipid profile	Age group		P Value
1	**Hypercholesterolemia**	**≥40**	**<40**	
	No	135	255	**0.001**
	Yes	101	100	
2	**Hypertriglyceridemia**			
	No	234	143	**0.008**
	Yes	156	58	
3	**HDL category**			
	0-40	131	50	0.08
	41-50	129	78	
	>50	130	73	
4	**LDL levels**			
	Normal	151	239	0.008
	High	101	100	

There was a Statistical association between hypercholesterolemia, triglycerides, LDL levels and the age group of the study participants with P value ≤ 0.05.

Table no. 2 showing the association between Gender of the study participants and Lipid profile.

Sl No	Lipid profile	Gender		P Value
1	**Hypercholesterolemia**	**Male**	**Female**	
	No	99	137	0.08
	Yes	124	231	
2	**Hypertriglyceridemia**			
	No	134	243	0.14
	Yes	89	125	
3	**HDL category**			
	0-40 mg/dL	91	90	**0.001**
	41-50 mg/dL	78	129	
	>50 mg/dL	54	149	
4	**LDL Levels**			
	Normal	98	154	0.61
	High	125	214	

Significant association was found between gender and HDL category. Levels of HDL was more seen in females comparing to males (P value= 0.001)

Table no. 3 showing the association between BMI and Lipid profile of the study participants

Sl No	Lipid profile	BMI		P Value
1	**Hypercholesterolemia**	**Overweight and above**	**Normal and below**	
	No	130	94	0.2
	Yes	209	121	

Continue.....

2	**Hypertriglyceridemia**			
	No	199	160	0.001
	Yes	140	55	
3	**HDL category**			
	0-40	112	53	0.001
	41-50	131	68	
	>50	96	94	
4	**LDL category**			
	High	198	131	0.47
	Low	146	106	

Level of triglycerides, HDL and LDL were also found to be significantly associated with BMI. Levels of Triglycerides and LDL were more in groups having higher BMI when compared to normal or low BMI, whereas HDL decreases with increase in BMI. (P value ≤ 0.05).

Table no. 4 Association between Waist Hip ratio (WHR) and Lipid profile of the study participants.

Sl No	Lipid profile	WHR		P Value
1	**Hypercholesterolemia**	**Normal**	**High**	
	No	24	212	0.81
	Yes	34	321	
2	**Hypertriglyceridemia**			
	No	44	333	0.04
	Yes	14	200	
3	**HDL category**			
	0-40	12	169	0.17
	41-50	21	186	
	>50	25	178	
4	**LDL category**			
	Normal	26	226	0.72
	High	32	307	

Hypertriglyceridemia was seen more in people with higher WHR (P value=0.04).

Table no. 5 showing association between hypertensive status and lipid profile

Sl No	Lipid profile	Hypertensive status		P Value
1	**Hypercholesterolemia**	**Normal**	**Hypertensive**	
	No	131	105	**0.001**
	Yes	149	206	
2	**Hypertriglyceridemia**			
	No	Normal	180	**0.002**
	Yes	High	131	
3	**HDL category**			
	0-40	73	108	0.07
	41-50	103	104	
	>50	104	99	
4	**LDL category**			
	Normal	129	123	0.1
	High	151	188	

There is significant association between hypercholesterolemia and hypertriglyceridemia.

Table no.6 showing association between Diabetes and Lipid profile of the study participants.

Sl No	Lipid profile	Diabetic status		P Value
1	**Hypercholesterolemia**	**Normal**	**Diabetes**	
	No	164	72	0.64
	Yes	253	102	
2	**Hypertriglyceridemia**			
	No	290	87	0.001
	Yes	127	87	
3	**HDL category**			
	0-40	110	71	0.002
	41-50	154	53	
	>50	153	50	
4	**LDL category**			
	Normal	76	176	0.74
	High	98	241	

Hypertriglyceridemia and HDL levels were found to be significantly associated with Diabetes.

Table no. 7 showing correlation matrix between the continuous variable and the Triglyceride levels.

		Weight	SBP	DBP	FBS
Triglyceride	Pearson Correlation coefficient r	0.158	0.165	0.182	0.255
	P Value	0.0001	0.0001	0.0001	0.0001

Pearson Correlation test was used to find the correlation between the continuous variables and various parameters of lipid profile.

There is a weak positive correlation obtained between body weight, blood pressure, fasting blood sugar levels with the Triglyceride (P <0.01)

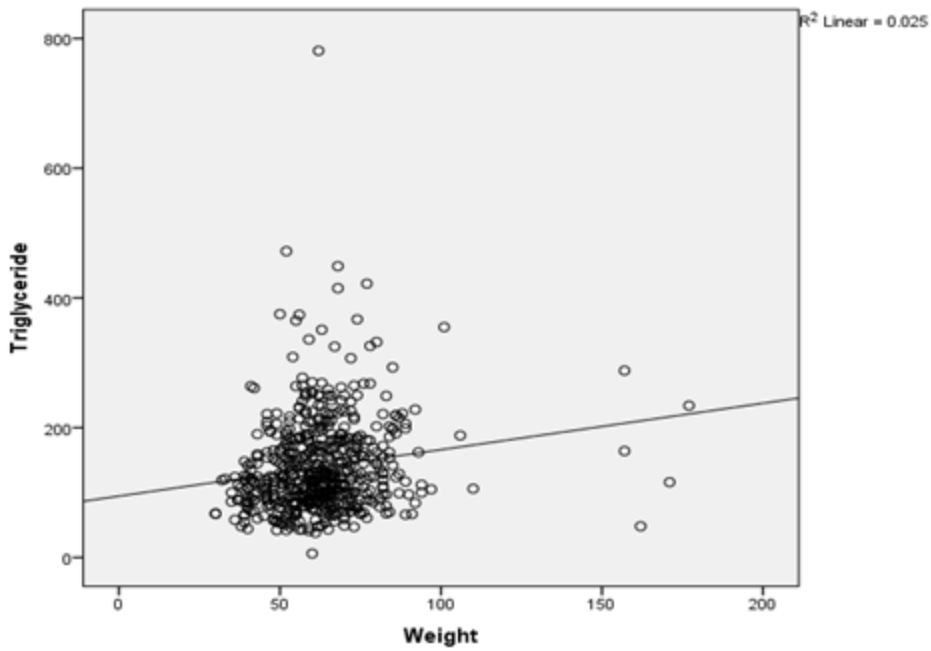

Figure no. 1 showing scatter plot diagram of triglyceride levels and weight of the participants

A weak positive correlation was identified between the triglyceride value and body weight. The triglyceride level increases with increase in weight (r=0.158, p value =0.0001)

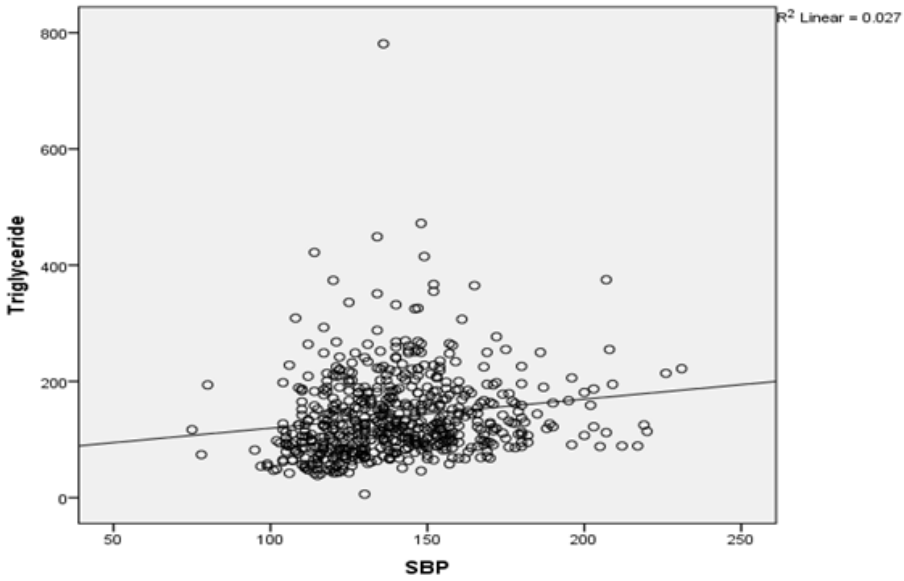

Figure no. 2 showing scatter plot diagram of triglyceride levels and systolic blood pressure of the participants

Weak positive correlation was seen between triglyceride level and systolic BP. (r=0.165, p value =0.0001).

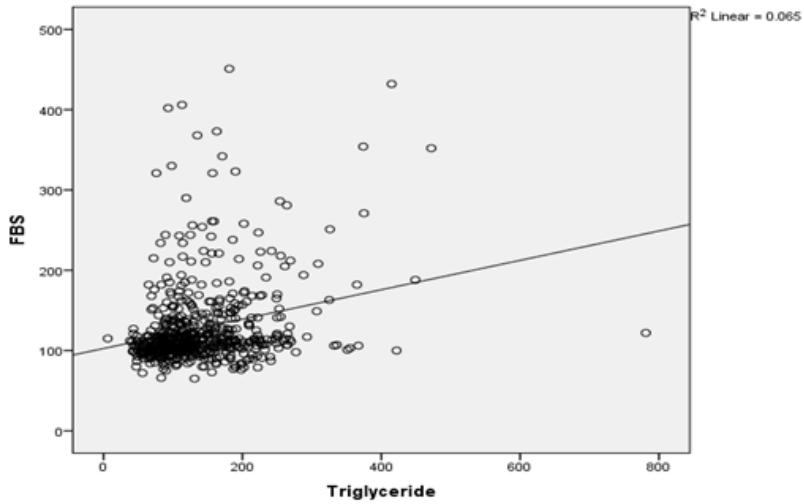

Figure no. 3 showing scatter plot diagram of triglyceride levels and fasting blood sugar of the participants

Fasting blood glucose level and triglyceride levels were found to have weak positive correlation. (Pearson correlation coefficient r= 0.255, p value= 0.0001)

Discussion

In our study, the Prevalence of dyslipidaemia/ hypercholesterolemia was found to be 60.1%. Similar results were found in another study conducted by Ashlesh et al in northern Kerala, where the prevalence of dyslipidaemia was found to be 63.8%[1]. However, another study conducted by Joshi et al showed that only 13.9 % of the rural population had dyslipidaemia[11]. Study conducted by Ajay et al showed a prevalence of dyslipidaemia among urban

and rural population was found to be 74.5% and 68.8% respectively[9]. Study conducted by Nirwan et al showed the overall prevalence of dyslipidaemia was 80%[10]. Study conducted by Vijaykumaret al showed that 37 % of the rural population had dyslipidaemia.[12]. Our result was much higher than the global prevalence published by the World Health Organization[13]. In our study, the total cholesterol levels, triglycerides, LDL levels were found to be high in older age groups when compared to the younger people. Another study showed that there is a declining trend in lipid levels after 40 years of age[14]. In our study higher lipid levels are found in participants having higher BMI or overweight. Similar results were seen in a study conducted by Vijayakumar et al in rural population of Kerala[12]. Dyslipidaemia is closely related to insulin resistance. Obese people have higher risk of insulin resistance and lead to decreased clearance of VLDL, increased triglycerides and decreased HDL levels in blood[16].

In our study, lipids levels (except HDL levels) were found to be high in those who are more than 40 years of age ($p < 0.05$). In our study, the levels of total cholesterol and triglyceride were higher among females as compared to men. Similar results were found in the study conducted by Joshi et al[11]. However, another study showed that men have higher altered lipid levels as compared to females[14]. Higher lipid levels are seen in patients having higher BMI or overweight. Similar results were seen in a study conducted by Vijayakumar et al in rural population of Kerala.[12] The waist to hip ratio was also related to increased levels of triglycerides in blood. These findings were consistent with the results obtained from previous studies[16,17]. Triglycerides and HDL levels were found to be significantly associated with Hypertension and diabetic status of the patient similar to the previous studies [11,12]. In the study population, dietary consumption of excessive fat and calorie intake, together with inactivity, could be the main causes of dyslipidaemia. Deep-frying of foods and re-frying in the used oil can produce trans-fatty acid, which can also alter the lipid levels.

Strength and weakness

Our study was able to identify certain risk factors that may leading todyslipidaemia. Study estimated lipid profile of the study participants (triglyceride levels, HDL and LDL levels) other than just measuring total cholesterol. Demographic details like education, occupation, socioeconomic status was not determined. Also, the study did not assess the behavioural risk factors like lack of physical activity, dietary pattern and substance use. This study conducted over a short period of time, may not have captured long-term trends or changes in the lipid profile.

Conclusion and Recommendations

According to the findings in the study, hypercholesterolemia is highly prevalent in the rural Kerala. Altered total cholesterol and triglyceride levels were found to be significantly associated with age ≥ 40). The levels of total cholesterol and triglycerides were higher among females when compared to men. Higher lipid levels are seen in persons having higher BMI or overweight. High Waist–Hip ratio was also related to increased levels of triglycerides in blood. High Triglycerides and low HDL levels were found to be significantly associated with Hypertension and diabetic status of the participants. This study found that hypertension is associated with obesity. Obesity was significantly associated with hypercholesterolemia hence reduction in obesity can help to control lipid levels thereby reducing the hypertension. Dietary modifications, physical exercise also should be promoted to control serum lipid levels. Hypercholesterolemia was also seen in younger age groups. Early screening and preventive measure must be taken for lessening the disease burden.

Conflict of interest: None

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Ethical Clearance/Statement of Ethics: Ethical clearance was obtained from MES Ethics committee No.IEC/MES/13/2023

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