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Dyslipidemia Relationship with Socioeconomic Status in East Champaran Population

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ABSTRACT

Background: The study was conducted to analyze variabilities in lipid profile in East Champaran, Bihar adults by age, gender, smoking, BMI, exercise and income. Method: Blood sample of 100 subjects of mean age 27±7 were analyzed for Total Cholesterol, HDL-Triglyceride, LDL-C. Mean±SD conc. of the total cholesterol, HDL-cholesterol, LDL-cholesterol. Result: Total cholesterol was higher in individuals having blood pressure >120/80 mmHg than individuals having blood pressure (207±100 mg/dl vs 166±76 mg/dl; p=0.03). HDL-cholesterol was significantly higher in the younger age group (<30 yrs) than the older age group (>30 yrs) (45±10 mg/dl vs 41±9 mg/dl; p=0.03). The mean conc. of HDL-cholesterol was found significantly higher in the upper-income group (>25,000 Rs pm) than the lower-income group (<10,000Rs pm) (48±11mg/dl vs 40±8 mg/dl; p=0.001). The mean levels of triglycerides were significantly higher in males than females (191±88 mg/dl vs 154±74 mg/dl; p=0.02). Similarly, the mean value of triglycerides was significantly lower in individuals performing exercise than individuals who did not exercise (130±42 mg/dl vs 186±87 mg/dl; p=0.01), the mean triglyceride levels also were significantly higher in hypertensive individuals (207±100 mg/dl vs 166±76 mg/dl; p=0.03). Conclusion: This study showed that the level of lipids in blood and atherosclerosis relation is influenced by various lifestyle factors including smoking, daily physical activity, and socioeconomic status of the individual. Developing countries like India should consider these factors in health strategy planning.

Key words: *Dyslipidemia; Triglycerides; Socioeconomic status; BMI.*

INTRODUCTION

Dyslipidemia is a condition in which abnormal (high or low) amount of lipids, fat or triglyceride are found in the blood. In most of the developing countries like India, most abundantly found dyslipidemia is hyperlipidemia; that is, a rising level of lipids are found in blood, which is mostly due to high lipid diet and unhealthy lifestyle [1, 2]. The term lipid refers to substances with poor water solubility [3] that are transported in the bloodstream as macromolecular complexes [4]. These include biologically important materials such as sterols, including cholesterol, that are composed of hydrocarbon rings, and glycerides, such as triglycerides (TG) and phospholipids, that are chiefly composed of lipids with hydrocarbon chains, like CHO, may be oxidized to produce ATP for different metabolic processes [5]. If the body does not need them to produce urgent

energy then lipids are stored in adipose tissues (fat depots) in the body and inside the liver causing fatty liver disease. Few of lipids are utilized in the formation of structural molecules and some are used in synthesizing other necessary components, like phospholipids, constitutive of plasma membrane, lipoproteins, and also in the transportation of cholesterol, clotting factor-like thromboplastin that is used in clotting, and myelin sheet that speeds up the nerve impulse conduction [6]. The prolonged increase in insulin levels can be a cause of dyslipidemia [7]. Some studies have also shown that increased levels of O-GlcNAc transferase (OGT) can be a cause of dyslipidemia [8].

DEMOGRAPHIC FACTORS:

Age:

Hypercholesterolemia increases with increasing age in adults [9].

Gender:

Hypercholesterolemia is more common in men younger than 55 and in women older than 50 years [10].

Education:

As the level of education and socioeconomic status affect in developing countries differ a lot in different parts of a country very fewer studies have been done to find the prevalence of obesity, but the effects may be diametrically different in various populations around the world specially in developed countries [11].

Income:

In many countries, that the populations mostly include low and medium-income levels, obesity is less common especially in women, whereas it is found highest among those who are economically better or belong to high-income level [12]. Developing countries with low income especially South Asian countries like India, Pakistan, and Bangladesh, contribute a high burden of CVD, which is responsible for about 78% of all deaths and around 86.3% living with these disabilities in life for years [13].

Exercise / physical activity:

Exercise has little effect on LDLC, aerobic exercises may improve concentrations and level of TG and thus, may help reduce CHD risk [11]. The urbanization is found to reduce the level of physical activity, increase dietary with high fat, and following western diets, all have been implicated as significant environmental influences that contribute to the rapid increase in obesity worldwide. Risk for diabetes further increases with sedentary lifestyle or decreases with exercise [12, 14].

Many investigations have considered lower physical activity as an important factor that may affect human health and lead to CVD [13]. After physical activity, diet may also have operational impact on the quality of healthy life. Observational studies have confirmed the positive correlation between the effect of physical activity and general well-being, positive mood, self-perceived quality of life, as well as lower levels of anxiety, stress, and depression.

Smoking habit:

Smoking modestly lowers the serum HDLC concentrations and may induce insulin resistance [15]. Smoking habits, excessive alcohol use, and less physical activity are some of the important risk factors of myocardial infarction around the world. Rafiei et al. surveyed the lipid profile of 2200 randomly-selected subjects from the Isfahan population aged between 19-70 years to determine the prevalence of various types of hyperlipidemia and the mean concentration of serum TC, TG, LDL-C, and HDL-C [16, 17]. They concluded that the most prevalent lipid abnormality found in the Isfahan population is HDL-C, which can be improved by dietary intervention and physical activity [18]. A cross-sectional study in 2005 showed the co-relation between different lifestyle factors and plasma adiponectin levels in general Japanese male population. Statistics describe that hypoadiponectinimic persons had significantly higher levels of BMI, SBP, DBP, TC, FBG, and platelets and lower level of HDL-C. They concluded in their study that physical activity, dietary factor, and smoking are independently co-related to the plasma adiponectin level in the studied population. Adiponectin level could be a helpful biomarker in preventing T2DM and CVD by modifying their lifestyle [19].

MATERIALS AND METHODS

Design of Study
This was a cross-sectional comparative study.

Subjects / Participants:
This study was performed in different parts of Motihari district, Bihar from August 2018 to December 2019. The subjects were 58 men and 42 women aged 18 to 45 years. 80 out of 100 were hard-working while the remaining were students. All participants were interviewed by a specialist who used a self-administered Questionnaire. The subjects were divided into different groups on the basis of age, gender, BMI, smoking habit, incomes, and physical activity.

Exclusion Criteria:
On the basis of history, those suffering from diabetes mellitus, cardiovascular disease, hypertension, liver disease, tuberculosis or having pregnancy were excluded.

Inclusion Criteria:
Normal healthy individuals aged 18 to 45 of both sexes.

Material
Total material was based on self-administered Questionnaire and instruments

Questionnaire:
The questionnaire consisted of four parts.
Assessment of Demographic Data:
Self-administered questionnaire also included statistic data including characteristics like age, gender, marital status, and financial status. On the financial basis, population was divided into three groups (lower-income Rs. 10,000 or below per month, middle-income Rs. 10,000 to Rs 25,000 per month, and upper-income Rs. 25,000 or above per month).

Assessment of Anthropometric Data:
The height of volunteers was measured without shoes in cm and weight was also measured without shoes and in light clothing in kilograms (kg). The body mass index was calculated as weight in kilogram over (divided by) height in meter squared. Blood pressure was measured using a mercuric sphygmomanometer and stethoscope on the right arm, twice with the subject in sitting position and with at least 5 minutes rest between the 2 measures. The values used in this study were the averages of the two measures.

Waist to Hip Ratio
Waist size was measured at the constrictive diameter between the costal margin and the crest while the hip perimeter was measured at the greatest diameter over the buttock.

Evaluation of lifestyle habits:
The interviewer asked questions about physical activity (exercise), its types, as well as the duration of activity per day. Also, questions were asked related to those activities that were performed by the individuals during their leisure times in order to evaluate the total physical activity performed daily. Some questions were related to the smoking habits for which smokers were divided into two groups on the basis of their smoking habits, smoker and non-smokers, and the number of cigarettes smoked each day.

Assessment of Maternal / Paternal Medical History:
Questions were asked the individuals related to the maternal or paternal history of having any disease like hypertension, cardiovascular disease, diabetes mellitus, liver disease, etc.

Sample Collection and Testing:

5ml venous blood was collected from each participant by trained medical staff and immediately transferred into the heparinized tubes. The serum was separated by centrifugation and stored it in Eppendorf at -60ºC until analysis. TC and HDL-C were analyzed by using the colorimetric kit method (CLONITAL), TG was analyzed by using the colorimetric kit method (CHROMATEST), and the concentration of LDL-C was calculated by using Friedewald's et al. formula.

Statistical analysis:

The data analysis was done using SPSS version 22 for windows. The variables were shown as percentages and frequencies. Chi-square test was used for assessing the dependent variables. P-value <0.05 was considered as significant.

RESULT & DISCUSSION

Table 1: Effect of Age, Gender, BMI, Smoking, Exercise, Income, etc. on serum levels of total cholesterol, triglyceride, HDL-cholesterol, LDL-cholesterol, and total lipid.

S. No	FACTORS	NUMBER	LIPID CONCENTRATION (mg/dl)				
		(n)	TC	HDL-C	LDL-C	TG	TL
1	AGE						
	>30	36	175±48	41±9	98±40	184±95	541±252
	<30	64	168±34	45±10	95±38	166±68	394±233
			p value=0.4	p value=0.03	p value=0.6	p value=0.3	p value=0.005
2	GENDER						
	Male	59	176±55	39±9	102±57	191±88	567±244
	Female	41	174±44	47±7	85±40	154±74	394±237
			p value=0.9	p value=4.4	p value=0.1	p value=0.02	p value=0.0005
3	SMOKING						
	Yes	13	178±35.4	27±3	105±36	220±73	569±221
	No	46	171±44	41±8	96±42	180±90	567±252
			p value=0.6	p value=3	p value=0.4	p value=0.1	p value=0.9
4	EXERCISE						
	Yes	16	164±35	46±8	86±35	130±42	507±278
	No	84	175±40	42±9	99±39	185±87	493±252
			p value=0.3	p value=0.1	p value=0.2	p value=0.01	p value=0.8
5	BMI						
	>25	19	163±38	42±9	100±40	168±53	506±260
	<25	81	169±37	45±10	84±33	165±37	446±236
			p value=0.1	p value=0.1	p value=0.1	p value=0.8	p value=0.3
6	INCOME						
6 (a)	L income	51	166±36	40±8	97±36	171±87	573±213
	M income	34	177±48	43±9	103±47	184±83	555±261
			p value=0.2	p value=0.07	p value=0.5	p value=0.4	p value=0.8
6 (b)	M income	34	178±46	43±10	102±46	182±81	460±237
	U Income	15	182±49	48±11	85±27	173±78	391±210
			p value=0.7	p value=0.1	p value=0.2	p value=0.7	p value=0.3
6 (c)	L income	51	166±36	40±8	96±35	170±87	549±257
	U Income	15	184±49	48±11	86±26	173±78	391±210

			p value=0.1	p value=0.001	p value=0.3	p value=0.9	p value=0.03
7	**HYPERTENSION**						
	>120/80	26	207±100	40±10	101±41	207±100	547±264
	<120/80	74	166±76	43±9	95±37	166±76	478±252
			p value=0.03	p value=0.2	p value=0.5	p value=0.03	p value=0.2
8	**Family history of hypertension, diabetes obesity**						
	Yes	46	174±45	42±8	97±40	181±85	517±250
	NO	54	176±44	42±10	97±37	171±84	475±259
			p value=0.8	p value=0.9	p value=0.9	p value=0.5	p value=0.9

Data of Table 1 shows the effect of age, gender, BMI, smoking, income, exercise, B.P mmHg, and family history of obesity, hypertension, and heart problems on the lipid levels of adult subjects. Mean levels of total cholesterol were found to be significantly higher in individuals having blood pressure >120/80 mmHg than those individuals having blood pressure <120/80 mmHg (207±100 mg/dl vs 166±76 mg/dl; p=0.03). The mean levels of HDL-cholesterol were found to be significantly higher in the younger-age (<30 yrs) group than the older (>30 yrs) age group (45±10 mg/dl vs 41±9 mg/dl; p=0.03). Similarly the mean concentration of HDL-cholesterol was found to be significantly higher in the upper-income group (>25,000 Rs pm) than the lower-income (<10,000Rs pm) group (48±11mg/dl vs 40±8 mg/dl; p=0.001). The mean levels of triglycerides were found to be significantly higher in males than females (191±88mg/dl vs 154±74 mg/dl; p=0.02). Similarly, the mean levels of triglycerides were also significantly lower in individuals who performed exercise than those individuals who did not perform exercise (130±42 mg/dl vs 186±87 mg/dl; p=0.01). The mean triglyceride levels were also significantly higher in individuals having B.p >120/80 mmHg than those having B.p <120/80 mmHg (207±100 mg/dl vs 166±76 mg/dl; p=0.03). The mean levels of the total lipid were found to be significantly higher in older-age (>30 yrs) group than the younger-age (<30 yr) group (541±252 mg/dl vs 394±233 mg/dl; p=0.005). The total lipid levels were also significantly higher in males than in females (567±244 mg/dl vs 394±237 mg/dl; p=0.0005). Similarly, the mean triglyceride levels were significantly higher in the lower-income (<10,000 Rs p.m) group than upper-income (>25,000 Rs p.m) group (549±257 mg/dl vs 391±210 mg/dl; p=0.03). The combined effect of age, gender, income, exercise, and blood pressure mmHg was significantly associated with the total cholesterol, triglyceride, total lipid, and HDL-cholesterol, while LDL-cholesterol was not significant by age, gender, income, exercise, BMI, smoking, and blood pressure mmHg.

Table 2. Prevalence of Hypercholesterolemia, Hypertriglyceridemia, Low HDL-Cholesterolemia, and High LDL-Cholesterolemia in adult subjects.

S.NO	VARIABLES	FREQUENCIES (%)		
		Males(n=59)	**Female(n=41)**	**Total(n=100)**
1	Hypercholesterolemia	15 (25%)	6 (14.6%)	21 (21%)
	>200 mg/dl			
2	Hypertriglyceridemia	35 (59.3%0	13 (32%)	48 (48%)
	>150 mg/dl			
3	Low HDL-Cholesterol	9 (15.2%)	18 (44%)	27 (27%)
	Males < 35 mg/dl			
	Females < 45 mg/dl			
4	High LDL-Cholesterol	14 (24%)	7 (17%)	21 (21%)
	> 130 mg/dl			

Table 2 shows the prevalence of hypercholesterolemia, hypertriglyceridemia, low HDL-cholesterolemia, and high LDL-cholesterolemia. The frequencies of hypercholesterolemia was found to be 25% in males and 14.6% in females. Concentration of hypertriglyceridemia average value found was 48% (59% males, 32% females), average low HDL-cholesterolemia concentration recorded was 27% (15% males, 44% females) , and high LDL-cholesterolemia average value was 21% (24% males, 17% females). This is clear from the Table that hypercholesterolemia frequency was higher in males (15%) than females (6%).

Table 3. Frequencies of different variables.

S.NO	VARIABLES	FREQUENCIES
1	**AGE**	
	>30	36
	<30	64
2	**GENDER**	
	Males	59
	Females	41
3	**BMI**	
	<25	81
	>25	19
4	**SMOKING**	
	Yes	13(22%)
	No	46(78%)
5	**EXERCISE**	
	Yes	16
	No	84
6	**INCOME**	
	L Income	51
	M Income	34
	U Income	15
7	**HYPERTENSION**	
	>120/80	26
	<120/80	74
8	**Family history of hypertension, diabetes, obesity**	
	Yes	46
	No	54

Data in Table 3 shows the frequencies of different variables. In the case of age, 36% of the individuals were >30 years of age whereas 64% of the individuals were <30 years of age. Out of a total of 100 individuals, 59 individuals were males while 41 were females. 19% of individuals had BMI >25 while 81% of the individuals had BMI <25. 22% of males were smokers, while 78% of males were non-smokers. 16% of the total individuals performed regular exercise. 51% of the individuals belonged to the lower-income group (<10,000 Rs p.m) and 34% belonged to middle income (Rs 10,000-Rs 25,000 p.m), while 15% belonged to upper income (Rs >25,000 p.m). 26% of the individual had blood pressure >120/80 mmHg. 46% of individuals had a family history of obesity, diabetes or hypertension.

Table 4. Demographic and Clinical characteristics of adult subjects (n=100).

S.NO	VARIABLES	VALUE	SUBJECT
		mean ± SD	**(%)**

1	AGE (yrs)	27±7	
2	GENDER		
	Male		59
	Female		41
3	BMI (kg/m)	22±5.5	
4	SMOKING		
	Yes		13(22%)
	No		46(78%)
5	Cholesterol (mg/dl)	174±43	
6	Triglyceride (mg/dl)	176±84	
7	HDL-Cholesterol (mg/dl)	42±9	
8	LDL-Cholesterol (mg/dl)	97±39	
9	Total Lipid (mg/dl)	495±255	

Table 4 shows the demographic and clinical characteristics of adult subjects. There were 59 males and 41 females. The mean age of the group was 27±7 yrs. The mean BMI 22±5. 22% of individuals were smokers. The mean values of serum total cholesterol, triglyceride, HDL-cholesterol, LDL-cholesterol, and total lipid were 174±43 mg/dl, 176±84 mg/dl, 42±9 mg/dl, 97±39 mg/dl, and 495±255 mg/dl, respectively.

The abnormalities related to lipid and lipoprotein are found to play a leading role in the development and advancement of CAD. Low levels of HDLC and high levels of LDLC have been known as autonomous coronary risk factors [20]. Nowadays, one of the most common and fatal diseases in the world is CVD [21]. Under CVD ischemic heart disease is one of the main reasons for death in all developed countries, as well as developing countries. Various studies conducted on the Indian population have shown that the rate of mortality due to ischemic heart disease in India is as high as in developed countries [22]. Abnormal conditions in the lipid concentrations have been found to be a common problem in the Indian population specially in status with a high population like Bihar and U.P and it is also one of the leading factors for coronary artery disease. Since it is a modifiable risk factor, observance and treating lipid status in the normal adult population in India will have a productive effect on decreasing the rate of coronary artery disease (CAD). There have been only a few reports on the detailed analysis of lipids on normal adult Indian subjects. In Bihar, the increased level of triglycerides is a common feature found in our study. This could be due to related genetic structure and nutritional habits, which involve high saturated fat present in this population.

Some researches from Framingham proposed that the blood triglyceride levels are an autonomous risk factor for CAD. It was found that the Indian male population has high levels of triglyceride and low levels of HDL-cholesterol in comparison to females. Smokers had decreased levels of HDL-cholesterol. Smoking is an accepted risk factor on the basis of large study data for causing acute myocardial infarction, related to endothelial dysfunction and can precipitate coronary spasm [23].

[n a population-wide based study, the effect of BMI in the overweight and obese ranges on the pandemic of CHD and stroke was partly autonomous of the major risk factors like raised blood cholesterol, high blood pressure, physical inactivity, and cigarette smoking [24]. In our study, average population found to have HDL-cholesterol level below normal range, which is <35mg/dl for male an <45 mg/dl for females as recommended by National cholesterol education program me indicating that low HDL-cholesterol in our population may have been one of the factors contributing to high rates of CAD. In fact, the prevalence of low HDL-cholesterol in males (<35mg/dl) and females (<45mg/dl) in our population was 15% for males and 44% for females.

Our study had some limitations but despite them, this study that its subjects did not represent the general population, has defiantly points towards the very high prevalence of hypertriglyceridemia and low HDL-cholesterolemia in Indian adults and might be considered as a leading risk factor for CAD in India and around the world. The lipid abnormalities may be due to our eating habits, physically inactive lifestyle, and genetic makeup. These two lipid abnormalities constitute “Atherogenic Dyslipidemia” which is one of the 6 components of ‘Metabolic Syndrome”. This syndrome possesses a significant health risk to individuals and is a growing health problem in this country. CVD is a major global health problem reaching epidemic proportions,

high risk of CVD has been reported in South Asian populations [24]. The active media campaign is required for promoting health measures, which can decrease the levels of triglycerides and high levels of HDL-cholesterol, such as engagement in healthy physical activity, cessation of smoking, and use of low-fat diet, which include more polyunsaturated fatty acids that help control CVD (cardiovascular diseases) in our population [25]. On the basis of many research, the characteristic of obesity in predisposing subjects to diabetes, hypertension, and other types of CVD risk is well established, and obesity contributes to racial/ethnic disparities in CVD risk [26]. Some changes in lifestyle are considered useful as a first line of treatment for dyslipidemia [27]. Our study provided evidence that physical activity patterns, age, gender, race, ethnicity, psychosocial conditions, and socioeconomic status affect the development of obesity in people and can affect the BMI at which they occur.

CONCLUSION

Our study showed that a large population of adult males and females have blood lipid abnormalities in the East Champaran district of Bihar. Considering all limitations, low-fat diet, good socioeconomic status, and physical activity appear effective, as non-pharmacological interference for controlling high blood lipid levels. It was also found that reducing the smoking frequency and consumption of other tobacco-related products, following a healthy lifestyle and increasing physical activity together with medium or no alcohol consumption appears to be an attractive measure in controlling hypercholesterolemia and hyperlipidemia.

DECLARATIONS

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Conflict of Interest
The author declares no competing interests.

Contributions of authors
We declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors. Dr. Johra khan proposed this work and prepared a draft. Miss. Asma and Dr. Johra khan conducted all experimental works. Dr. Mohammad Alaidarous and Asma Naseem read and approved the draft.

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