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Research Article

ASSOCIATION OF SELECTED RISK FACTORS OF CORONARY HEART DISEASE WITH LIPID PROFILE

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ABSTRACT

Objective: The objectives of this study is to assess the association of selected risk factors for coronary heart disease (CHD) with lipid profile.

Methods: A cross-sectional study was conducted during May 2013–April 2014 among 350 subjects of 25–64 years selected by systematic random sampling. Data on sociodemographic and medical and personal history along with anthropometric measurements were collected through house-to-house visit. Blood sample was analyzed for fasting blood sugar and lipid profile.

Results: In this study, 38.58% belong to the age group of 25–35 years and 58% were female. Majority (45.43%) of the participants belonged to lower socioeconomic status, followed by the middle (40.57%) and upper class (14%). It was observed that total cholesterol was significantly associated with blood sugar (p=0.0008), blood pressure (p=0.001), and body mass index (BMI) (p=0.018). There was no significant association among the risk factors of CHD such as smoking and alcohol with total cholesterol. Low-density lipoprotein level was significantly associated with BMI (p=0.0001) and blood sugar (p=0.003). There was a significant association among the risk factors for CHD such as smoking (p=0.002), alcohol, (p=0.017) blood sugar (p=0.004), and BMI (p=0.014) with triglyceride level.

Conclusion: It was concluded from this study that various risk factors for CHD were associated with lipid abnormalities. Hence, a community-based education in this regard is of paramount importance.

Keywords: Body mass index, Coronary heart disease risk factors, Cholesterol, Dyslipidemia.

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INTRODUCTION

Irrespective of the vast progress made in the identification of the etiology and the treatment of cardiovascular diseases, people are still becoming prey to these diseases in developing countries like India. It was observed by the World Health Organization that, by the year 2020, coronary heart disease (CHD) and stroke would occupy the first and fourth places as the leading causes of disability and mortality. It was estimated that the incidence of coronary vascular diseases would increase from 2.90 crore in 2002 to about 6.40 crore in 2015. The etiology of CHD is multifactorial [1]. Together with elevated blood pressure, obesity, and diabetes mellitus, dyslipidemia is a component of the metabolic syndrome and associated with increased CHD risk [2]. Smoking which is recognized as a major risk factor for the development of ischemic heart disease may lead to altering the normal plasma lipoprotein pattern. An earlier study showed that increased cholesterol levels and CHD are observed in smokers [3]. The study also showed a strong synergistic interaction exists between hypercholesterolemia and tobacco consumption in the genesis of CHD [1]. CHD is increasingly seen in younger age groups among diabetics [4]. Lipid profiles in people with diabetes tend to be characterized by elevated very low-density lipoprotein (LDL), LDL, and high-density lipoprotein (HDL). People with diabetes and a raised cholesterol level experience greater risk of heart disease. Overweight increases the risk of having a heart disease because obese people are more likely to have hypertension, diabetes, and high levels of bad cholesterols [5]. Association of lipid profile with risk factors of CHD such as smoking, diabetes, obesity, hypertension, and history of alcoholism has not been explored in this area. Thus, the present study was conducted to find the association of different lipid components to CHD risk factors.

METHODS

Study setting

The study was conducted in the Urban Health and Training Centre (UHTC), functioning under the Department of Community Medicine.

Sample size

Population in the age group of 25–64 were 3459 as identified in the study area was considered as the study universe. Studies published earlier [6] on the determination of prevalence of CHD risk factors in urban Indian population have revealed that the most common dyslipidemia was low HDL to the tune of 54%. Using this prevalence, sample size was calculated using 4 pq/L^2 formula with 10% error, which was found to be 341. Thus, a sample was rounded off to 350.

Sampling

Systematic random sampling was used to arrive at the required sample size. Samples were selected from house-to-house visit. It was considered that at any given point of time at least two members would be present. Sampling interval was 12 and every 12^{th} house was visited after selecting the first house randomly. Study subjects who were found eligible and were present during the house-to-house visit were included in the study till a total of 350 subjects were reached. In case of a locked house, the next door household was considered for the study.

Study design
It was a community-based cross-sectional study where a pre-designed and pre-tested questionnaire was used to collect information with respect to sociodemographic profile, and history of smoking, alcohol, and diabetes was collected. Their height, weight, and blood pressure were recorded. The information was collected by the social worker, whereas interns helped in the physical examination during door–to-door survey. The laboratory technician collected blood for investigations such as fasting blood sugar and lipid profile of all study subjects which sent immediately to the laboratory of IMS and SUM hospital for analysis.

Study instrument
The questionnaire was finalized after pre-testing in the field on ten subjects with refinement at different stages of preparation. The questionnaire was prepared by following WHO STEPS approach.

Study duration
The study has been conducted for 1 year from May 2013 to April 2014.

Data analysis
The data were analyzed using SPSS (20.0v) software. Outcome variables were expressed as percentages. Proportions were compared using Chi-square test. A $p<0.05$ was considered as statistically significant.

Ethical considerations
The detailed study protocol was submitted to the Institutional Ethics Committee of IMS and SUM Hospital and the approval was obtained. An informed written consent was obtained from each study participant before conducting the survey. Before obtaining the consent, the participants were explained in detail about the procedure in the local vernacular language, and their participation was voluntary. All the participants were provided appropriate advice and referral services at UHTC and SUM Hospital following evaluation of clinical and laboratory findings. Methods adopted during survey are as follows: Educational status: Categorization of the educational status was done according to the following criteria. Illiterate: An illiterate person was considered to be one who could not read and write or a person who could merely read but could nt write. Lower primary: A person who had done his/her schooling up to 4^{th} class. Upper primary: A person who had done his/her schooling up to or anywhere between 4^{th} and 8^{th} classes. Secondary: A person who had done his/her schooling up to or anywhere between 9^{th} or 10^{th} class. Higher secondary: A person who had done his/her schooling up to or anywhere between 11^{th}, 12^{th} class or/and diploma. Graduate and above: A person who had done his/her graduation and above. Socioeconomic status (SES): For the assessment of social class, Prasad's classification was used. To update this classification, the All India Consumer Price Index for the year, 2013, was considered when the value was fixed at 1075 [7]. Social Class I and II labeled as upper class, social class III as middle, and social class IV and V as lower.

Height
The measuring scale (fiber tape) used to mark the values on the wall. After removal of the shoes, the study subject was made to stand on a flat floor against the scale with feet parallel and with heels, buttock, shoulder, and back of head touching upright by placing a scale horizontally on the head is used to measure the height.

Weight
To measure weight, an electronic weighing machine was used. The patients were weighed without any footwear. Body mass index (BMI) was calculated as weight (kg) divided by height squared (mt^2) and interpreted as follows. BMI ≥25 was taken as overweight/obese. Blood pressure: Using a sphygmomanometer, blood pressure of the study participants was checked in sitting position. If the participant is anxious, asked to wait for few minutes before taking blood pressure. Participants with a history of treatment for hypertension, having a systolic blood pressure ≥140 or diastolic blood pressure ≥90, or both were considered as hypertension.

Smoking
Participants who smoked at least 100 cigarettes in their lifetime and at the time of interview smoke every day or some days were considered as a smoker.

Alcohol
Person consuming five drinks or more on 1 day in 1 month was considered as a risk factor for CHD in this study.

Laboratory investigations
Blood samples are collected from all the participants with a disposable syringe in two separate sterile containers and send to the laboratory, for blood sugar levels and lipid profile. Fasting blood sugar level ≥110 mg/dl is considered as raised blood sugar or deranged blood sugar which is one of the risk factors. Total blood cholesterol level ≥200 mg/dl, LDL level ≥100 mg/dl, triglyceride (TG) level ≥150 mg/dl, and HDL level <40 mg/dl were considered as dyslipidemia and risk factors for CHD.

RESULTS

Table 1 shows the sociodemographic profile of the participants. Maximum participants (38.58%) belonged to the age group of 25–35 years and 11.72% of the participants belonged to the age group of more than 55 years. About 58% of the participants were female. More number of participants (45.43%) belongs to lower class of SES, followed by middle (40.57%) and upper class (14%). Nearly 17% of the participants were illiterate and 35.43% of the participants studied till primary education, followed by graduation and higher 21.14%.

Table 2 presents highly significant association between blood sugar level of study participants and the level of total cholesterol status. It indicates those who have high blood sugar also had high total cholesterol level. Similarly, there was a significant association between blood pressure and total cholesterol status. Those participants who had high blood pressure also had high total cholesterol level. We also observed a significant association between BMI and total cholesterol level; it indicates that obese persons had high total cholesterol status. We did not get any significant association between smoking and total cholesterol level. Furthermore, no significant association was observed between alcohol consumption and total cholesterol level in our study.

Table 3 summarizes no significant association among the risk factors of CHD such as smoking, alcohol, blood pressure, blood sugar, and BMI with HDL level.

Table 4 shows highly significant association between the BMI of study participants and LDL status; it indicates that obese person had high LDL level. Similarly, the significant association was observed between blood sugar and LDL level. No significant association was observed between smoking and LDL level. Similarly, no significant association was observed between alcohol consumption and blood pressure with LDL level.

Table 5 presents a significant association among the risk factors of CHD such as smoking, alcohol, blood sugar, and BMI with TG level. No association was observed between blood pressure and TG level.

DISCUSSION

Cigarette smoking is an important and independent risk factor of CHD. Smoking adversely affects the concentration of the plasma lipids and lipoprotein levels. A study done by Alharbi [8] on the influence of cigarette smoking on lipid profile observed no significant association between serum cholesterol level among smoker and non-smoker. However, all other components of lipid profile (LDL, HDL, and TG) were found significantly increased for smokers. Prevalence of hypertension was more in females with advancing age and with the exposure to risk factors, i.e., alcohol and smoking in a study conducted by Venkataram *et al*. [9]. A similar type of study done by Devaranavadgi *et al*. [10] on the effect of cigarette smoking on blood lipids, in Belgaum, Northern

Karnataka, India, observed the mean value of serum total cholesterol, serum LDL-cholesterol (LDL-C), and serum TG in cigarette smokers is significantly higher as compared to non-smokers. Another study done by Rao on the effect of chronic tobacco smoking and chewing on the lipid profile showed decreased levels of HDL cholesterol and increased levels of total cholesterol, LDL cholesterol, and TG in smokers as compared to those in non-smokers [1]. However, in our study, we did not get any significant association between smoking and blood total cholesterol level, smoking with blood HDL level and LDL level. However, we observed a significant association between smoking and blood TG level.

The complex relationship between alcohol use and lipid profile has been documented by earlier studies. The influence of alcohol on lipid metabolism is to be attributed to the transient changes in lipid metabolism. Our study result is consistent with the study of Vaswani *et al.* who observed TG was higher in alcohol dependents as compared to non-dependent [11]; however, in contrast to our findings, there was no significant association observed among alcohol consumption and blood total cholesterol level. A study done by Riuidavets *et al.* [12] found that blood levels of HDL-C increased with increased alcohol intake. Similarly, a study conducted by Barboriak *et al*. showed significantly higher HDL-cholesterol (HDL-C) levels in the alcoholic group [13]. They also noticed that, after 2 weeks of alcohol abstinence, the HDL-C levels decreased to normal range. A study done by Choudhary *et al.* found higher serum HDL-C in heavy alcohol drinkers [14]. However, in our study, there was no significant association observed between alcohol consumption and blood HDL level.

Table 1: Sociodemographical profile of participants (n=350)

Variables	Categories	n (%)
Age group (year)	25–35	135 (38.58)
	>35–45	115 (32.85)
	>45–55	59 (16.85)
	>55	41 (11.72)
Gender	Male	147 (42)
	Female	203 (58)
SES	Lower class	159 (45.43)
	Middle class	142 (40.57)
	Upper class	49 (14)
Education	Illiterate	59 (16.86)
	Primary	124 (35.43)
	Secondary	60 (17.14)
	Higher secondary	33 (9.43)
	Graduate and higher	74 (21.14)

SES: Socioeconomic status

Table 2: Association of risk factors of CHD with total cholesterol level

Variables	Total cholesterol status (n=350)		p value
	Normal (n)	Abnormal (n)	
Smoking			
Smoker	22 (68.75)	10 (31.25)	0.611
Non-smoker	232 (72.95)	86 (27.05)	
Alcohol			
Alcoholic	28 (77.77)	8 (22.23)	0.459
Non-alcoholic	226 (71.97)	88 (28.03)	
Blood sugar			
Normal	230 (75.66)	74 (24.34)	0.0008
Deranged	24 (52.17)	22 (47.83)	
Blood pressure			
Normal	209 (76.55)	64 (23.45)	0.001
Hypertension	45 (58.44)	32 (41.56)	
BMI			
Normal	157 (77.33)	46 (22.67)	0.018
Overweight/obese	97 (65.98)	50 (34.02)	

Figures in parenthesis indicate percentages. CHD: Coronary heart disease, BMI: Body mass index

Table 3: Association of risk factors of CHD with HDL level

Variables	HDL level (n=350)		p value
	Normal (n)	Abnormal (n)	
Smoking			
Smoker	16 (50)	16 (50)	0.114
Non-smoker	204 (64.15)	114 (35.85)	
Alcohol			
Alcoholic	24 (66.66)	12 (33.34)	0.617
Non-alcoholic	196 (62.42)	118 (37.58)	
Blood sugar			
Normal	191 (62.82)	113 (37.18)	0.977
Deranged	29 (63.04)	17 (36.96)	
Blood pressure			
Normal	174 (63.74)	99 (36.26)	0.521
Hypertension	46 (59.74)	31 (40.26)	
BMI			
Normal	130 (64.04)	73 (35.96)	0.590
Overweight/obese	90 (61.22)	57 (38.78)	

Figures in parenthesis indicate percentages. CHD: Coronary heart disease, BMI: Body mass index, HDL: High-density lipoprotein

Table 4: Association of risk factors of CHD with LDL level

Variables	LDL level (n=350)		p value
	Normal (n)	Abnormal (n)	
Smoking			
Smoker	11 (34.37)	21 (65.63)	0.091
Non-smoker	159 (50)	159 (50)	
Alcohol			
Alcoholic	16 (44.44)	20 (55.56)	0.600
Non-alcoholic	154 (49.04)	160 (50.96)	
Blood sugar			
Normal	157 (51.64)	147 (48.36)	0.003
Deranged	13 (28.26)	33 (71.74)	
Blood pressure			
Normal	140 (51.28)	133 (48.72)	0.056
Hypertension	30 (38.96)	47 (61.04)	
BMI			
Normal	116 (57.14)	87 (42.86)	0.0001
Overweight/obese	54 (36.73)	93 (63.27)	

Figures in parenthesis indicate percentages. CHD: Coronary heart disease, BMI: Body mass index, LDL: Low-density lipoprotein

Table 5: Association of risk factors of CHD with TG level

Variables	TG level (n=350)		p value
	Normal (n)	Abnormal (n)	
Smoking			
Smoker	12 (37.5)	20 (62.5)	0.002
Non-smoker	207 (65.09)	111 (34.91)	
Alcohol			
Alcoholic	16 (44.44)	20 (55.56)	0.017
Non-alcoholic	203 (64.64)	111 (35.36)	
Blood sugar			
Normal	199 (65.46)	105 (34.54)	0.004
Deranged	20 (43.47)	26 (56.53)	
Blood pressure			
Normal	177 (64.83)	96 (35.17)	0.099
Hypertension	42 (54.54)	35 (45.46)	
BMI			
Normal	138 (67.98)	65 (32.02)	0.014
Overweight/obese	81 (55.10)	66 (44.90)	

Figures in parenthesis indicate percentages. CHD: Coronary heart disease, BMI: Body mass index, TG: Triglyceride

Dyslipidemia is one of the common disorders which are seen in most of the diabetes patients, which causes cardiovascular disorders. In our study, the results showed lipid profile of the diabetics which were higher than that of the non-diabetic. Highly significant association was observed between blood sugar level of the participants and the level of blood total cholesterol status. Similarly, the significant association was observed between blood sugar and blood LDL level and blood sugar with blood TG level. However, no significant association was observed between blood sugar and blood HDL level. Similar results observed by Samatha *et al*. in their study, i.e., diabetic patients had a higher prevalence of high serum cholesterol, high TG, and high LDL-C than that of controls non-diabetic [15]. The correlation studies showed by Samatha *et al*. had a negative non-significant correlation (r=−0.024) between FBG and HDL-C, whereas positive significant correlations were recorded between FBG and TC (r=0.584) and FBG and TG (r=0.514) [15].

The results concluded that blood total cholesterol was statistically significant in hypertensive subjects. The result is consistent with the studies of Bamrara *et al*. [16] and Kanwar *et al*. [17] who also observed blood total cholesterol was statistically significant in hypertensive patient. However, in our study, LDL and TG were statistically not significant in hypertensive subjects. The result is in contrast with Bamrara *et al.* [16] and Kanwar *et al.* [17], and they observed that LDL-C and TG were statistically significant in hypertensive subjects. In a study conducted among Filipinos by Urrutia *et al*., results showed that females have more risks of developing heart attack than males for patients with hypertension, with diabetes, with a family history of CVD, and those who are smoking [18].

The result of our study in relation to HDL level is in consistent with a study done by Saha *et al*., who also observed that blood HDL level was statistically not significant in hypertensive patient [19].

The dyslipidemia associated with obesity no doubt plays a major role in the development of CVD in obese individuals. Ranganathan *et al*. in their study observed that the total cholesterol, the LDL, and the TGs are found to be relatively high among the subjects with high BMI when compared with normal BMI persons, and this difference was found to be statistically significant, whereas HDL cholesterol had not shown any significant difference between the two groups [18]. Our study findings showing significant association of BMI with total cholesterol, LDL, and TGs and non-significant association between BMI and HDL level were similar to of Ranganathan *et al.* study [20]. Shamai *et al.,* in their study, assessed the relationship between BMI and lipid fractions. They observed that higher BMI was inversely associated with HDL and directly associated with TG. BMI showed no significant association with LDL [21].

CONCLUSION

In this study, we tried to show how the various risk factors of CHD such as smoking, diabetes, obesity, hypertension, and alcoholism are associated with lipid profile (total cholesterol, HDL, LDL, and TG level). From the study, we concluded that blood sugar, blood pressure, and BMI are significantly associated with total cholesterol level. Blood sugar and BMI are significantly associated with LDL level. Smoking, alcohol, blood sugar, and BMI significantly associated with TG level. However, in our study, we did not get any significant association between smoking and total cholesterol level, smoking with HDL and LDL level, which is in contrast with other study. Therefore, studies with a larger sample size are required to confirm these results. Further, this study has shown that lipid abnormalities are associated with various risk factors for CHD. It indicates that treatment of CHD in a patient should include correction of dyslipidemia and other risk factors. Hence, a community-based education in this regard is of utmost importance.

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