The Prevalence Of Hyperlipidemia In Patients Suffering From Coronary Artery Disease

*HUMAYUN HAQ**
*AZHAR MEHMOOD KIYANI***

Summary:

Dyslipidemia along with a number of other risk factors, some known others unknown predisposes to Coronary Artery Disease (CAD) and its dreaded complications. Aggressive intervention both at primary and secondary levels reduces its incidence along with significant reduction in morbidity and mortality associated with it. The purpose of this study was to determine the prevalence of hyperlipidemia in a population with documented evidence of CAD and to compare the results with important published international studies. A total of 540 patients were recruited and their lipid profile was studied. These parameters were also observed for other variables like age, sex and occupation to find out if a particular group was at greater risk of developing disturbed lipid profile. The results showed that out of the total population suffering from CAD, 35% of cases had total cholesterol of <200mg%. Nearly half of the cases had cholesterol between 200-239 mg% and only 16% of cases had very high cholesterol levels (249-529 mg%). The mean total cholesterol (n=540) was 214.68 + S.D. 39.35 (95% C.I. 211.37-217.99). Mean Triglycerides (n=260) were 168.62 + S.D. 57.18 (95% C.I. 161.66—175.58), and mean LDL (n=258) 150.22, + S.D. 8.84 (95% C.I. = 144.30 — 156.14). Mean HDL (n=261) was 50.13, + S.D. 17.2 (95%C.I. = 48.07-52.19). Total lipids (n=258) 730.79+S.D.134.83 (95%C.I. 714.35 —747.23). Lipid profile parameters (total cholesterol, LDL, triglycerides) were borderline above the parameters recommended by The National Cholesterol Education Programme but below the level indicated for conservative Therapy. There was no difference in the lipid parameters when compared between the two sexes and for those above or below 50 years of age. Similarly no significant difference was found when a sample serving in the forces was compared to a civilian sample. Thus the study concludes that the prevalence of deranged lipid profile in a local population with CAD is similar to other studies around the world.

Introduction:

Risk factor reduction is the primary clinical approach to prevent Coronary Artery Disease (CAD). Epidemiological studies have shown that hyperlipidemia, whose importance as a major risk factor has been established beyond doubt, acts in a synergistic manner with other risk factors[1]. Individuals with coronary artery disease are at risk for a further CAD event, especially if they have modifiable risk factors. Secondary prevention is equally important. Studies have demonstrated that aggressive intervention in way of dietary modification and or drug therapy

reduces morbidity and mortality associated with CAD[2]. It is therefore not surprising that a number of communities have gone at great lengths in determining the incidence and prevalence of hyperlipidemia in their population[3].

The incidence of CAD in Pakistan is as high as in the western world[4]. Hypercholesterolemia, especially that carried as LDL is a potent risk factor for CAD. 70% of total cholesterol in the blood is present in LDL. Numerous prospective studies have established beyond doubt the importance of hypercholesterolemia in predicting initial CAD[5]. The same has been demonstrated for atherogenic LDL. On the other hand an inverse relationship exists between HDL cholesterol and occurrence of CAD[6]. Diet has a profound effect

* Resident Cardiologist, AFIC/NIHD.
** Consultant Cardiologist, AFIC/NIHD

on blood lipid content. In fact dietary modification is a risk free intervention whose efficacy is well established. The combined favourable effect of diet, regular exercise and weight loss on the occurrence of CAD is not only through improving lipid profile but

Prospective epidemiological studies have shown a continuous graded increase in the incidence of major CAD events by 2% for every 10% increase in total plasma cholesterol levels from the basal level of 180 mg/dl[10]. Lipid Research Clinic Primary Prevention

TABLE-1
PREVALENCE OF C.A.D. IN DIFFERENT LEVELS OF TOTAL CHOLESTEROL
(according to age and sex)

Total Cholesterol	Total Sample	Male	Female	Male <50yrs	Female <50yrs	Male >50yrs	Female > 50yrs
145-198 mg%	189 (35%)	142 (75%)	47 (25%)	91 (48%)	26 (14%)	51 (27%)	21 (11%)
200-239 mg%	259 (48%)	202 (78%)	57 (22%)	124 (48%)	31 (12%)	78 (30%)	26 (10%)
240-529 mg%	91 (17%)	55 (60%)	36 (40%)	27 (32%)	21 (22%)	26 (28%)	17 (18%)

also through better blood pressure control and improved glucose control. Saturated fats have a profound measurable effect on blood lipid level. This is revealed by the cross cultural population comparison of saturated fat intake with cholesterol levels and incidence of CAD provided by the seven countries collaborative study[7].

Daily energy intake from omega-6 poly

Trial (CPPT) has demonstrated that a combination of diet and cholestyramine reduce CAD by approximately 2% for every 10% reduction in plasma cholesterol. Oslo Trial has clearly demonstrated that vigorous diet control and stopping smoking reduces the incidence of CAD by almost 50% mainly by reducing cholesterol level[11]. In Framingham study for every 10mg increase in HDL cholesterol there were 50% fewer coronary events[12]. In Helsinki Heart Study 34% reduction in 5

TABLE-2
LIPID PROFILE IN C.A.D.
(according to age and sex)

	Total Population	95 % C.I (of mean)	Males	95 % C.I (of mean)	Females	95 % C.I (of mean)
Total Cholesterol	214.68 mg% (n=540)	211.37-217.99	213.70 mg% (n=383)	209.76-217.64	217.06 mg% (n=157)	210.93-223.19
Triglycerides	168.62% mg (n=260)	161.66-175.58	166.53 mg% (n=195)	161.66-175.58	174.88 mg% (n=65)	166.40-183.36
HDL	50.13 mg% (n=261)	48.07-52.19	49.16 mg% (n=196)	48.07-52.19	53.05 mg% (n=65)	50.10-56.11
LDL	150.22 mg% (n=261)	144.30-156.14	148.62 mg% (n=196)	144.30-156.14	155.03 mg% (n=65)	150.20-160.04
Total Lipids	730.79 mg% (n-251)	714.35-747.23	730.79 mg% (n=194)	714.35-747.23	756.31 mg% (n-64)	738.61-774.01

unsaturated fatty acids (PUFA), contained in large quantities in vegetable oils lowers blood cholesterol levels[8]. Weight gain increases total cholesterol, VLDL, LDL and triglycerides[9]. Exercise enhances the activity of lipoprotein lipase. The result is clearance of VLDL, LDL and triglycerides from the blood. HDL, on the other hand is increased.

year incidence of CAD was observed in middle aged men with hypercholesterolemia through a combination of Gemfibrazole and dietary advice[13].

Method:

This is a prospective study conducted at the

regional cardiac centre of CMH Multan. All patients (both male and female) attending the OPD during this period with documented evidence of CAD were included.

Documented evidence included ECG, Cardiac

TABLE-3
LIPID PROFILE IN C.A.D.
(according to sex and age)

	Males > 50 yrs	95% C.I (of mean)	Males <50 yrs	95% C.I (of mean)	Female >50 yrs	95% C.I (of mean)	Female <50 yrs	95% C.I (of mean)
Total Cholesterol	213.99 mg% (n=151)	206.17-221.17	212.61 mg% (n=223)	208.18-217.04	205.27 mg% (n=78)	200.43-210.11	218.10 mg% (n=92)	209.42-226.78
Triglycerides	159.18 mg% (n=83)	147.64-170.72	170.46 mg% (n=113)	160.20-180.72	166.04 mg% (n=23)	151.40-180.68	179.71 mg% (n=42)	154.37-205.50
HDL	47.27 mg% (n=83)	43.83-50.71	50.11 mg% (n=114)	47.64-52.59	58.26 mg% (n=23)	42.71-73.82	50.19 mg% (n=42)	46.17-53.21
LDL	159.99 mg% (n=83)	137.75-166.23	144.87 mg% (n=114)	137.29-152.45	152.83 mg% (n=23)	136.96-168.70	156.24 mg% (n=42)	142.42-159.56
Total Lipids	772.20 mg% (n=83)	687.76-756.25	716.21 mg% (n=113)	691.88-740.54	752.18 mg% (n=22)	703.84-740.92	763.71 mg% (n=42)	715.41-812.01

Enzymes and a positive Exercise Test. A total of 540 patients fulfilled the criteria and were included in the study. They were requested to attend for a blood test.

Blood samples were taken (after 9 hour fast) and commercial kits for analysis of lipid were used.

Out of the total population, 189 (35%) had total cholesterol in the normal range, in 259 cases (48%) it was slightly raised and was very high in 91 (17%) of cases. Out of the sample in the normal range 75% were men and 25% were women. The difference was less for those with very high levels as 60% were men and

TABLE-4
LIPID PROFILE OF ARMED FORCES POPULATION WITH C.A.D.
(according to age)

	Total Sample	95 % C.I (of mean)	> 50 yrs	95 % C.I (of mean)	< 50 yrs	95% C.I (of mean)
Total Cholesterol	208.09 mg% (n=246)	204.17-212.01	205.27 mg% (n=78)	200.43-210.11	209.40 mg% (n=168)	200.43-210.11
Triglycerides	161.20 mg% (n=123)	152.99-169.41	152.07 mg% (n=44)	140.33-163.81	166.29 mg% (n=79)	140.33-163.81
HDL	49.80 mg% (n=124)	47.02-52.58	49.41 mg% (n=44)	43.89-54.93	50.01 mg% (n=80)	43.89-54.93
LDL	141.97 mg% (n=124)	133.05-150.89	142.84 mg% (n=44)	124.89-160.79	141.49 mg% (n=80)	124.89-160.79
Total Lipids	700.56 mg% (n=122)	678.94-722.18	694.77 mg% (n=44)	644.70-724.84	703.82 mg% (n=78)	644.70-724.84

Serum was separated and analyzed according to the strict instructions given in commercial kits.

Data was collected and analyzed using statistical tests. Students' t. test was used. 95% of confidence intervals were calculated. Results are tabulated in tables 1-5.

40% were women in that range. This data was further analyzed by dividing the sample into those who are less than 50 years of age and those who are more than 50 years for both sexes. Table 1 summarizes this information.

Table 2 shows the pattern of lipid profile in the

sample population and then for both sexes. The average cholesterol in males was 213 mg% while in females it was 217mg%, showing no statistically significant difference between the two sexes.

Analysis of other lipid parameters had a similar result. The 95% C.I. for all results is given in the table as well.

of 75-85 years (protective). In the permissive range (T.Ch.=180-240 mg/dl, LDL=110-170 mg/dl) an MI is likely to occur at the age of 60-80 years. Very high levels (T Ch. 240-300 mg/dl, LDL 170-230 mg/dl), fall in the promotive range and may result in an acute coronary event during the prime years of 40-60 years.

In the Framingham study total cholesterol >240

TABLE-5

LIPID PROFILE IN CIVILIAN POPULATION WITH C.A.D.
(according to age)

	Total Sample	95 % C.I (of mean)	> 50 yrs	95 % C.I (of mean)	< 50 yrs	95% C.I (of mean)
Total Cholesterol	223.78 mg% (n=137)	215.53-232.03	223.78 mg% (n=137)	204.17-212.01	220.88 mg% (n=65)	212.94-228.82
Triglycerides	174.64 mg% (n=72)	161.06-190.22	175.64 mg% (n=72)	152.99-169.41	180.15 mg% (n=34)	157.30-203
HDL	48.07 mg% (n=72)	45.65-50.49	48.07 mg% (n=72)	47.02-52.58	50.35 mg% (n=34)	46.67-54.03
LDL	160.08 mg% (n=72)	148.10-172.06	160.08 mg% (n=72)	148.10-170.60	152.82 mg% (n=34)	144.30-161.30
Total Lipids	759.35 mg% (n=72)	726.25-792.45	759.35 mg% (n=72)	726.25-792.95	744.62 mg% (n=34)	703.14-756.24

The data of lipid profile for both sexes was further analyzed according to their ages. **Table 3** summarizes this information. Again no statistically significant difference was found.

Finally, the lipid profile patterns were studied in subjects serving in the armed forces **(Table 4)** and compared to the lipid profile patterns in the civilian population **(Table 5)**. Both groups were closely observed for any differences in those above and below the age of 50 years and no difference was found.

Discussion:

Much attention has been focused on the definition of "ideal" cholesterol. Extrapolation of results from various angiographic results in men and women have shown that the prevalence of significant lesion would be zero at a total cholesterol of 150 mg/dl. National Cholesterol Education Programme terms a level of 200 mg/dl or less of total cholesterol and 130 mg/dl for LDL as desirable. A level of 200-240 mg/dl is termed as borderline high while a cholesterol above 240 is definitely high.

Protective, permissive and promotive range of total and LDL cholesterol has been described. For example a total cholesterol level of 140-180 mg/dl and an LDL of 70-110 mg/dl is expected to cause an MI at the age

mg% was present in 30-45% of cases. The average cholesterol and LDL levels were 200 and 150mg/dl respectively.

It is worth mentioning that individuals with cholesterol level below 200mg% also suffered an MI. This was again documented in the Tufts New England Medical Centre where 35% of the patients with cholesterol below 200 had CAD and 73% of these had HDL level <35mg%.

The mean cholesterol level in the Framingham Study increased with age both in men and women (up to 50 and 65 years respectively) after which it tended to decline. Young women (below 50) had substantially lower cholesterol levels compared to men of similar age group. While the opposite was true for women above 50. In both sexes Cholesterol and LDL decreased above the age of 65. HDL levels were higher in women of all ages. The average cholesterol and LDL levels in men at which CAD occurred in the Framingham Study was between 223-227mg/dl (95% CI) and 145-156 mg/dl (95%CI) respectively. In women these levels were 247-249mg/dl and 162-166 mg/dl respectively. It is recommended that indication for treatment in men and women are total cholesterol and LDL levels >225 mg/dl (95%CI) and 240 respectively.

In this study 35% of the sample population with a

cholesterol level below 200 mg/dl developed CAD. This figure is similar to that quoted by the Tufts New England Medical Centre Study (35%) but is much higher than that found in the Framingham Study (20%). In both these studies the HDL level is less than 35mg% while in this study it was found to be 50mg%. It is possibly due to racial and ethnic factors compounded by life style. It is also possible that this population has CEPT gene effect.

It is important to note that 29% of the patients developed CAD below the age of 40 years with a lipid profile of total cholesterol 212mg%, LDL 50mg%, Triglycerides of 168mg% and HDL less than 50mg%. These values are below those mentioned in the Framingham Study and the levels recommended for treatment.

Patients in this study had high LDL and triglycerides 160 and 159mg% at all ages and groups. This is due to eating habits, type of food consumed and lack of exercise which clears LDL and triglycerides. 48% of the patients who developed MI had a cholesterol level between 200 and 239mg/dl, an LDL of 150, triglycerides of 168 and HDL score of 50. 78% of these were males and 22% represented by females. 48% of the males were below the age of 50 years while 14% were females. 14% of the population who developed CAD had cholesterol in excess of 240mg% (60% men, 40% women). 32% of males and 22% of females were below 50 years of age.

Average total cholesterol in the patients was 214mg/dl (95% CI 211-217), triglycerides 168.62% (95% CI, 161-175), HDL 50.13 (95% CI 48-52) and LDL of 150.22 (95% CI 144-156). These are comparable to those found in the Framingham study which shows an average Total cholesterol of 223-227 and LDL of 146-151. for men. Similarly the women were found to have an average total cholesterol of 247-249 and an LDL of 162-166.

It can be appreciated that the above mentioned lipid profile parameters are border line higher than those recommended by National Education Program (14).

There was no significant difference between the lipid profile levels in men and women compared for those under and over the age of 50 years. The same was true for males in the civilian population and males serving in the Armed forces. The average age at which CAD occurred in this sample population is 48 years.

For Correspondence:

Dr Humayun Haq, MRCP
Resident Cardiologist
Armed Forces Institute of Cardiology/National
Institute of Heart Diseases
The Mall, Rawalpindi.
E-Mail: drbilal@apollow.net.pk

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