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Association of Cholesterol-rich Lipoproteins with Coronary Artery Disease in Subjects Who Referred to Yazd Cardiovascular Research Center for Coronary Angiography

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Abstract: Coronary Artery Disease (CAD) is the leading cause of death in many populations, including Iranians. The best way to control CAD, is to identify and modify more effective local risk factors. The aim of this study was to determine and comparison of lipids, lipoproteins and lipoprotein (a) [Lp (a)] in patients with CAD and control subject who referred to cardiovascular research center. One hundred patients (37 females, 63 males) with CAD and 92 controls (58 females, 34 males) were investigated. The fasting plasma Total-cholesterol (TC), triglycerides (TG) and high-density lipoprotein cholesterol (HDL-C), were determined by routine laboratory methods. Lp (a), apo-A1 and apo-B100 were determined by electroimmunoassay method. Statistical test included, t-test for comparison of lipids and U-test for comparison of Lp (a) in two groups. TC and Low-density Lipoprotein Cholesterol (LDL-C) in patients (227±35 and 147±40 mg dL^{-1}, respectively) were higher than controls (208±54 and 127±39 mg dL^{-1}). There were not any significant differences in TG, HDL-C and apo-A1 between two groups, but apo-B100 was higher in patients (1.25±0.4 g L^{-1}) than controls (1.13±0.36 g L^{-1}). Lp (a) was higher in patients (25±27 mg dL^{-1}) than control (18.8±19.5), but was not statistically significant ($p = 0.067$). We concluded that high levels of cholesterol and cholesterol-rich lipoproteins are more associated with CAD. Lp (a) is more associated with CAD in women and TG is more effective risk factor for MI in our study population. These lipids and lipoproteins may be more effective local risk factor for incidence of CAD in some Iranian populations.

Key words: Lipids, lipoproteins, apolipoproteins, lipoprotein (a), coronary artery disease

INTRODUCTION

Coronary artery disease (CAD) is the leading cause of death in many populations, including Iranians (Sarraf-Zadegan *et al*., 1999a). The best way to control of CAD is to identify and modify the more effective and modifiable local risk factors. There are several groups of risk factors for atherosclerosis and cardiovascular disease (Acevedo *et al*., 2001). During the last decades, considerable interest has been directed towards the investigation of plasma lipids and related compounds in healthy and diseased individuals, as important CAD risk factors (Lada and Rudel, 2004; Grundy, 1986; Massaeli and Piers, 1995; Anderson *et al*., 1987; Castelli, 1986). The frequency of abnormality of lipids, lipoproteins and apolipoproteins varies between different populations (Webber *et al*., 1992). The plasma lipid levels are affected be age, gender, lifestyle, dietary habits, physical activity, obesity, smoking, endocrine disorder, contraceptive use and certain genetic predisposing factors (Quivers *et al*., 1992; Carlson and Bottiger, 1985; Schiekem, 1992; Tenkate *et al*., 1982). Some reports indicated a relatively high rate of CAD incidence in some region from Iran (Sarraf-Zadegan *et al*., 1999b). There are various groups of Iranian populations with different nutritional habits and lifestyle. So the aim of this study was to determination and evaluation of lipids, lipoproteins, apolipoproteins and lipoprotein (a) [Lp (a)] in a group of patients with CAD and control subjects who referred to Yazd Cardiovascular research center in Iran, for coronary angiography.

MATERIALS AND METHODS

One hundred patients (37 females, 63 males) with CAD, documented by coronary angiography and 92 controls (58 females, 34 males) with normal coronary

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angiogram were investigated. Early morning blood sample was collected after a 12 h overnight fast. Serum Total Cholesterol (TC) and triglycerides (TG) concentration were determined by enzymatic methods, using commercially available test kits on Technicon RA-1000 analyzer. High Density Lipoprotein-cholesterol (HDL-C) concentration was determined with dextran-sulfate-magnesium precipitation, followed by the same enzymatic method for TC. Low Density Lipoprotein-cholesterol (LDL-C) was calculated using Friedewald formula, when the TG concentration was less than 300 mg dL^{-1} (Friedewald *et al*., 1972). Apo-A1 was determined by immunoturbidimetry methd (Rieponen *et al*., 1987). Apo-B100 and Lp (a) were determined by the method of electroimmunoassay (Winfried, 1983). For statistical analysis SPSS (V.11.5) was used. Statistical test included, t-test for comparison of lipids, lipoproteins and apolipoproteins and U-test for comparison of Lp (a) in two groups.

RESULTS

TC and low-density lipoprotein cholesterol in patients were higher than controls. Table 1 shows the lipids, lipoproteins and apolipoproteins in patients and control group.

Lipids, lipoproteins and apolipoproteins profile also compared between 56 subjects with history of previous Myocardial Infarction (MI) and 110 subjects without history of previous MI. Comparison of lipids profile in subjects with history of MI and subjects without MI is indicated in Table 2.

There were no any significant differences between plasma Lp(a) levels in males with CAD and controls, but plasma Lp(a) levels was significantly higher in women with CAD than controls. Table 3 shows comparison of lipids, lipoproteins and apolipoproteins in two groups by sexes.

Table 1: Comparison of lipids, lipoproteins and apolipoproteins in patients with coronary artery disease and control group

	Patients (n =100) Mean±SD	Controls (n = 92) Mean±SD	p
TC (mg dL^{-1})	227.00±35	208.00±54	0.009
TG (mg dL^{-1})	237.00±112	213.00±116	0.16
HDL-C (mg dL^{-1})	35.00±8	39.00±9.5	0.007
LDL-C (mg dL^{-1})	147.00±40	127.00±39	0.002
Apo A1 (g L^{-1})	1.24±0.36	1.30±0.33	0.24
Apo B100 (g L^{-1})	1.25±0.40	1.13±0.36	0.033
Lp (a) (mg dL^{-1})	25.00±27	18.80±19.6	0.067

TC- Total Cholesterol, TG = Triglycerides, HDL-C = High Density Lipoprotein Cholesterol, LDL-C = Low Density Lipoprotein Cholesterol, Lp (a) = Lipoprotein (a)

Table 2: Comparison of lipids, lipoproteins and apolipoproteins in subjects with previous history of Myocardial Infarction (MI) and subjects without previous history of MI

	MI (n = 56)	Without MI (n = 110)	p
TC (mg dL^{-1})	232.00±47	211.00±51	0.009
TG (mg dL^{-1})	254.00±129	210.00±104	0.029
HDL-C (mg dL^{-1})	36.00±9	37.50±9	0.21
LDL-C (mg dL^{-1})	153.00±44	131.00±37	0.005
Apo A1 (g L^{-1})	1.29±0.38	1.27±0.32	0.65
Apo B100 (g L^{-1})	1.28±0.45	1.17±0.34	0.085
Lp (a) (mg dL^{-1})	25.00±28	21.00±21	0.32

TC- Total Cholesterol, TG = Triglycerides, HDL-C = High Density Lipoprotein Cholesterol, LDL-C = Low Density Lipoprotein Cholesterol, Lp (a) = Lipoprotein (a)

Table 3: Comparison of lipids, lipoproteins, apolipoproteins and Lp(a) in patients with coronary artery disease and control by sexes

	Females		Males		p	
	Case	Control	Case	Control	Female	Male
TC (mg dL^{-1})	253±45	221±50	212±38	184±52	0.003	0.005
HDL-C (mg dL^{-1})	37±7	40±10	34±8.5	37±8	0.13	0.16
LDL-C (mg dL^{-1})	169±41	133±37	136±34	117±40	<0.001	0.037
TG (mg dL^{-1})	248±90	223±127	231±122	196±95	0.31	0.17
Apo-A1 (g L^{-1})	1.4±0.34	1.33±0.31	1.16±0.34	1.26±0.37	0.32	0.19
Apo-B100 (g L^{-1})	1.45±0.45	1.21±0.39	1.14±0.32	0.99±0.23	0.009	0.021
Lp(a) (mg dL^{-1})	31.7±31	18.86±20	21±23	18.8±18.8	0.016	0.61

TC- Total Cholesterol, TG = Triglycerides, HDL-C = High Density Lipoprotein Cholesterol, LDL-C = Low Density Lipoprotein Cholesterol, Lp (a) = Lipoprotein (a)

DISCUSSION

The results of the present study indicated the association between the higher levels of TC, LDL-C and apo-B100 with CAD. These factors collectively related to plasma cholesterol levels and transport. Lp(a), another cholesterol-rich lipoprotein also was higher in patients than controls, but this differences was not significant in all subjects, but it was significant in females. Apo B previously reported as the best predictor of CAD in a group of Iranians who referring to cardiovascular research center in Tehran and were candidate for coronary angiography (Haidari *et al*., 2001). Azizi *et al*. (2003) also reported relatively higher levels of TC, LDL-C and TG in a healthy Iranian group of adults in comparison to most other populations. In our control subjects, TC and LDL-C plasma levels are similar, but plasma TG was relatively higher than those reported by Azizi. This may be due to different life style and dietary habits in two populations. In addition our population was subjects who candidate for coronary angiography and therefore they were more attended for plasma lipids control.

On the other hand, in patients with history of previous MI in addition to TC and LDL-C, plasma levels of TG was significantly higher than subjects without MI. HDL-C and apoA1 are not any significant differences between patients with MI and without MI. However some reports have been attended to more importance of apolipoproteins, particularly apo-B as a risk factor and predictor of CAD in some Iranian populations

(Haidari *et al*., 2001; Rahmani *et al*., 2002). Results of this study have been shown relatively more importance of cholesterol than apo-B and apo-A1. Apo-A1 did not show any significant differences between either CAD patients and control, nor MI and without MI subjects. Apo-B was higher significantly in CAD patients than controls, but it was not any significant differences between MI and without MI subjects. In the basis of Tehran lipids and glucose study results, have been reported that high levels of plasma cholesterol and low levels of HDL-C are the most frequent cardiovascular risk factors in Tehran urban population (Azizi *et al*., 2002).

Another noticeable finding in this study was higher levels of plasma Lp (a) in female patients than female control. Lp (a) is an atherothrombogenic cardiovascular risk factor, that its plasma levels and its atherogenisity is vary between different ethnic groups (Lip and Jones, 1995). So, it seems that Lp (a) have been a more effective cardiovascular risk factor for females in our study population. Sex-specific association of Lp (a) with coronary artery disease reported in some other populations (Frohlich *et al*., 2004; Onta *et al*., 2005). In another study, Cassedy *et al*. (2004) have been shown a sex-specific association of Lp (a) with coronary artery calcification in an asymptomatic population. They evaluated 661 (285 men, 376 women) asymptomatic, white individuals and concluded that, Lp (a) alone may be an independent risk factor for coronary atherosclerosis in women, while in men, Lp (a) may confer higher risk conditional on the presence and level of other risk factors. Therefore, Lp (a) may be more effective cardiovascular risk factor in women than men in some situations.

We concluded that high levels of cholesterol and cholesterol-rich lipoproteins, are more associated with CAD in our study population. Lp (a) is more associated with CAD in women and TG is a more effective risk factor for MI in present study population conditions. These lipids and lipoproteins may be more effective local risk factor for incidence of CAD and MI in some Iranian populations.

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REFERENCES

Acevedo, M., R. Tagle and C. Simpfendorfer, 2001. Non-traditional risk factors for atherosclerosis. Rev. Med. Chil., 129: 1212-1221.

Anderson, K.M., W.P. Castelli and P. Levy, 1987. Cholesterol and mortality: Thirty years of follow-up from the Framingham study. JAMA., 257: 2176-2180.

Azizi, F., M. Rahmani, A. Ghanbarian, H. Emami, P. Salehi, P. Mirmiran and N. Sarbazi, 2003. Serum lipid levels in an Iranian adults population: Tehran lipid and glucose study. Eur. J. Epidemiol., 18: 311-319.

Azizi, F., M. Rahmani, H. Emami and P. Mirmiran *et al*., 2003. Cardiovascular risk factors in an Iranian urban population: Tehran lipid and glucose study (phase 1). Soz. Praventivmed, 47: 408-426.

Carlson, L.A. and L.E. Bottiger, 1985. Risk factors for ischemic heart disease in men and women: Results of the 19-year follow-up of the Stockholm prospective study. Acta. Med. Scand., 218: 207-211.

Cassedy, A.F., L.F. Bielak, I.J. Kullo and G.G. Klee *et al*., 2004. Sex-specific associations of lipoprotein (a) with presence and quantity of coronary artery calcification in an asymptomatic population. Med. Sci. Monit., 10: 493-503.

Castelli, WP., 1986. The triglyceride issue: A view from Framingham. Am. Heart J., 112: 432-437.

Grundy, S.M., 1986. Cholesterol and coronary heart disease: A new era. J. Am. Med. Assoc., 256: 2849-2858.

Friedewald, W.T., R.I. Levy and D.S. Fredrickson, 1972. Estimation of the concentration of low density lipoprotein cholesterol in plasma without use of centrifuge. Clin. Chem., 18: 449-502.

Frohlich, J., M. Dobiasova, L. Adler and M. Francis, 2004. Gender differences in plasma levels of lipoprotein (a) in patients with angiographically proven coronary artery disease. Physiol. Res., 53: 481-486.

Haidari, M., M. Moghadam, M. Chinicar, A. Ahmadieh and M. Doosti, 2001. Apolipoprotein-B as the best predictor of coronary artery disease in Iranian normolipidemic patients. Clin. Biochem., 34: 149-155.

Lada, A.T. and L.L. Rudel, 2004. Associations of low density lipoprotein particle composition with atherosclerosis. Curr. Opin. Lipidol., 15: 19-24.

Lip, G.Y.H. and A.F. Jones, 1995. Lipoprotein (a) and vascular disease: Thrombogenesis and atherogenesis. QJM., 88: 529-539.

Massaeli, H. and G.N. Piers, 1995. Involvement of lipoproteins, free radicals and calcium in cardiovascular disease processes. Cardiovas. Res., 29: 597-603.

Onta, A., M. Yazici, G. Hergenc and Y. Dogan *et al*., 2005. Lipoprotein (a) in a population-based study: More significant in Turkish women than men? Anadolu. Kardiol. Derg., 5: 271-277.

Quivers, E.S., D.L. Driscoll and C.D. Garvey, 1992. The effect of diet on serum cholesterol in children. Ann. NY Acad. Sci., 623: 133-134.

Rahmani, M., F. Raiszadeh, S. Allahverdian, S. Kiaii, M. Navab and F. Azizi, 2002. Coronary artery disease is associated with the ratio of apolipoprotein A-I/B and serum concentration of apolipoprotein B, but not with paraoxonase enzyme activity in Iranian subjects. Atherosclerosis, 162: 381-389.

Rieponen, P., J. Marniemi and T. Rautaoja, 1987. Immunoturbidimetric determination of apolipoprotein A-1 and B in serum. Scand. J. Clin. Lab. Invest., 47: 739-744.

Sarraf-Zadegan, N., F.A. Sayed-Tabatabaei, N. Bashardoost, A. Maleki and M. Totonchi *et al*., 1999a. The prevalence of coronary artery disease in an urban population in Isfahan, Iran. Acta. Cardiol., 54: 257-263.

Sarraf-Zadegan, N., M. Boshtam, H. Malekafzali and N. Bashardoost *et al*., 1999b. Secular trends in cardiovascular mortality in Iran, with special reference to Isfahan. Acta. Cardiol., 54: 327-333.

Schiekem, R.M., 1992. Effect of exercise on lipids. Ann. NY Acad. Sci., 623: 269-271.

Tenkate, L.P., H. Boman, S.P. Diager and A.C. Mostulsky, 1982. Familial genetic risk factors. Am. J. Cardiol., 50: 945-953.

Webber, L.S., S.M. Hunter and L.C. Johnson, 1992. Smoking, alcohol and oral contraceptives. Effect on lipids during adolescence and young adulthood: Bugalosa Heart study. Ann. N.Y. Acad. Sci., 623: 269-271.

Winfried, M. and G. Werner, 1983. Quantification of human serum lipoprotein Lp (a): Zone immunoelectrophoresis assay, a new sensitive method as compared to electroimmuno assay. Clin. Chim. Acta, 134: 265-279.