Prevalence and Profiles of Dyslipidemia in Apparently Healthy Adult Gujarati Population

Sibasis S. Sahoo[1], Tarun Madan[2], Kamal H. Sharma[2], Sharad R. Jain[3], Komal H. Shah[4], Yogini A. Kandre[5]

[1]Assistant professor in cardiology department, [2]Associate professor in cardiology department
[3]Professor in cardiology department, [4]Research officer in research department, [5]Laboratory technician in research department, U. N. Mehta Institute of Cardiology and Research Center, Ahmedabad
Corresponding Author : Dr. SibasisSahoo, E-mail: sibasissahoo@gmail.com

Abstract :

Introduction : Circulating lipids and lipoproteins are long being recognized as risk factors for developing cardiovascular diseases (CVD). **Objective :** To evaluate the prevalence and profiles of dyslipidemia in young and asymptomatic Gujarati population. **Method :** In this cross sectional study we had randomly selected 1440 individuals of the both the genders who were of 20- 40 years of age and disease free. Individuals having history of any medications for diabetes, hypertension and CVD were excluded from the study. The remaining healthy individuals underwent detained physical examinations and tests of lipid profiles. **Results :** In the overall population, the prevalence of low HDL-C (36.53%) and high lipoprotein (a) (32.15%) were most common lipid abnormalities found. We have observed that except for lipoprotein (a) (28.4% Vs35.66%),the males were more dyslipidemic than females ($p<0.001$). Age-wise distribution showed that younger individuals (20-29 years) were having superior lipid profile as compared to their older counterparts (30-40 years) ($p<0.001$). In population having lipoprotein (a) abnormality (32.15%), the low HDL-C (33.7%) was highly prevalent. **Conclusion :** Thus it is concluded that the young Gujarati population is highly susceptible to develop lipoprotein (a) and HDL-C abnormalities and this information could be used to design the preventive polices for future CVD events.

Key words : Dyslipidemia, Gujarati population, High-density lipoprotein cholesterol (HDL-C), Lipoprotein (a)

Introduction :

It is a well-established fact that the South Asians around the globe, especially of Indian sub-continent has higher risk and wider prevalence of cardiovascular diseases (CVD) as compared to rest of ethnic groups. [1]The rates of coronary artery diseases (CAD) in Indian population are 50% to 300% higher than other populations, with a higher risk at younger ages. [2] Deaths related to CAD occur 5 to 10 years earlier in Indian sub-continent than in western countries. [3] In spite of their proven greater susceptibility to CVDs, significant gaps in the knowledge of CVD epidemiology and associated risk factors in India exist. Reviews of epidemiological studies suggest that all the major cardiovascular risk factors such as tobacco consumption, obesity, hypertension and lipid abnormalities are increasing in India especially in young population. [4]A genetic tendency of CAD development, facilitated by high levels of serum lipids and lipoprotein (a) [Lp (a)], evidently increases the adverse effects of traditional risk factors related to lifestyle and best explains the "South Asian Paradox".[5] Although dyslipidemias - the major modifiable risk factor does not fully explain the excess burden of CAD, it is doubly important and remain the foundation of preventive and therapeutic strategies in this population. A more aggressive approach to preventive therapy, at an earlier age and at a lower threshold is clearly needed.

Keeping in mind the prime role of dyslipidemia in CAD development in young, we aimed to investigate the prevalence of lipid and Lp (a) abnormalities in young and apparently healthy Gujarati population.

Method :

Design and Data Collection

This cross sectional study was conducted at U. N. Mehta Institute of Cardiology and Research Center in September 2013. We had randomly selected 1440

individuals of both the genders (697 males & 743 females), who were young (20 – 40 years), apparently healthy and disease free. The study protocol was approved and cleared by institutional ethics committee. The demographic details of the population such as age, sex and disease history were recorded for all the individuals. Race-ethnicity was determined by self-identification in response to a questionnaire.

The subjects taking any medications for hypertension, dyslipidemia, diabetes or any other disease were excluded from the study. Individuals having positive stress test were also excluded from the investigating protocol.

Laboratory tests

Subjects were advised to fast at least for twelve hours before blood investigations. Total cholesterol (TC), triglycerides, low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C), very low density lipoprotein (VLDL), and total lipid, were measured by International Federation of Clinical Chemistry (IFCC) approved enzymatic methods using commercially available kit on auto analyzer (ARCHITECH PLUS ci4100, Germany). Lipids levels were classified according to the classification recommended by National Cholesterol Education Program (NCEP) and Adult Treatment Panel III (ATP III) guidelines.

Statistical analysis

All collected data were analyzed by SPSS v 20 (Chicago, IL, USA). Distribution analysis showed that most of the parameters follow non-Gaussian distribution. Values of various lipids were expressed as mean ± SD. The categorical data obtained from standard cut offs were presented as proportions. Comparison between the groups was done using Mann-Whitney U test and the cut off value of $p<0.05$ was considered for the statistical significance.

Results :

The results of overall dyslipidemia prevalence and profile in young Gujarati population are presented in table 1 as mean ± SD as well as proportions. We have observed that out of 1440 individuals 36.53% (526)were suffering from low levels of HDL-C. Whereas levels of Lp (a), LDL-C and total cholesterol were found to be elevated in 32.15% (463), 18.75% (270) and 17.77% (256) of the population respectively. The ratios of various lipids often provide more precise prognostic values in comparison to isolated lipid levels. In the current study, TC/HDL-C ratio was found to be increased in 482 (33.47%) and LDL-C/HDL-C ratio in 409 (28.4%) subjects. The abnormalities of total lipids, VLDL and triglycerides were observed in 12.57% (181), 8.61% (124) and 5.35% (77) of the population. The mean values obtained for Lp (a), total cholesterol, triglyceride, HDL-C, LDL-C, LDL-C/HDL-C ratio, TC/HDL-C ratio, VLDL and total lipids were 28.58 ± 26.17 mg/dl, 169.7 ± 34.4 mg/dl, 101.64 ± 59.31 mg/dl, 43.84 ± 9.98 mg/dl, 105.6 ± 29.1 mg/dl, 2.56 ± 1.14, 4.08 ± 1.5, 20.31 ± 11.8 mg/dl and 615.2 ± 81.69 mg/dl.

Table 1 : Demographic Details of the study population

Variables	Mean ± SD	N (%)
Age	28.779 ± 5.62	-
Lipoprotein (a)	28.579 ± 26.17	463 (32.15%)
Total Cholesterol	169.7 ± 34.4	256 (17.77%)
Triglyceride	101.64 ± 59.307	77 (5.35%)
HDL-C	43.84 ± 9.98	526 (36.53%)
LDL-C	105.599 ± 29.1	270 (18.75%)
LDL-C/HDL-C	2.563 ± 1.138	409 (28.4%)
TC/HDL-C	4.08 ± 1.5	482 (33.47%)
VLDL	20.31 ± 11.8	124 (8.61%)
Total Lipids	615.2 ± 81.69	181 (12.57%)

HDL-C: High Density Lipoprotein Cholesterol, LDL-C: Low Density Lipoprotein Cholesterol, TC: Total Cholesterol, VLDL: Very Low Density Lipoprotein

The influence of gender and age on dyslipidemias is tabulated as table 2 and table 3 respectively. The results stated that females are highly protected from dyslipidemia as all the lipids except Lp (a) were significantly ($p<0.01$) higher in males as compared to females. The abnormalities of various lipids such as Lp (a), total cholesterol, triglyceride, HDL-C, LDL-C, LDL-C/HDL-C, TC/HDL-C, VLDL and total lipids were 28.4%, 25.1%, 8.75%, 52.65%, 27.83%, 44.2%, 51.8%, 13.1% and 19.4% in

males whereas in females the prevalence were 35.66%, 10.9%, 2.15%, 21.4%, 10.2%, 13.6%, 16.3%, 4.04% and 6.2% respectively.

Table 2 : Prevalence of dyslipidemia according to gender

Variables	Males – 697 N (%)	Females - 743 N (%)	Significance (p value)
Lipoprotein(a)	198 (28.4%)	265 (35.66%)	0.0038
Total Cholesterol	175 (25.1%)	81 (10.9%)	<0.0001
Triglyceride	61 (8.75%)	16 (2.15%)	<0.0001
HDL-C	367 (52.65%)	159 (21.4%)	<0.0001
LDL-C	194 (27.83%)	76 (10.2%)	<0.0001
LDL-C/HDL-C	308 (44.2%)	101 (13.6%)	<0.0001
TC/HDL-C	361 (51.8%)	121 (16.3%)	<0.0001
VLDL	91 (13.1%)	30 (4.04%)	<0.0001
Total Lipids	135 (19.4%)	46 (6.2%)	<0.0001

HDL-C: High Density Lipoprotein Cholesterol, LDL-C: Low Density Lipoprotein Cholesterol, TC: Total Cholesterol, VLDL: Very Low Density Lipoprotein

The ageing trends of dyslipidemias presented in table 3 shows that in spite of 40 years of age being considered as young, the lipid profile of individuals in 4th decade of life is significantly poor as compared to individuals who are in 3rd decade of life.The study results demonstrated that the predominance of dyslipidemias in the population having age between 20-29 years was relatively lower (total cholesterol – 11.3%, triglyceride – 2.98%, HDL-C – 32.6%, LDL-C – 11.78%, LDL-C/HDL-C – 18.36%, TC/HDL-C – 22.3%, VLDL – 5.3% and total lipids – 8.1%). However the prevalence of Lp (a) abnormality was considerably high (29.65%) in this study group. In contrast to a decade younger population, individuals having age group of 30-40 years had significantly higher prevalence of various dyslipidemias. The elevation of Lp (a), total cholesterol, triglyceride, LDL-C, LDL/HDL, TC/HDL, VLDL and total lipids were found in 35.3%, 20.5%, 8.36%, 27.6%, 41.17%, 47.63%, 12.77%, and 18.3%, whereas low HDL-C had affected 41.5% of the population.

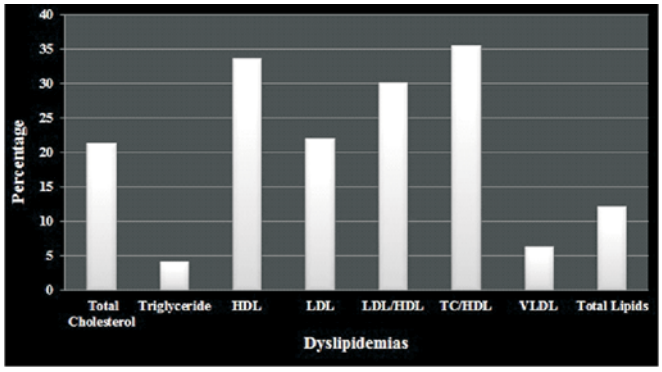
Table 3 : Prevalence of dyslipidemia according to age

Variables	Age (20-29 years) N= 806 N (%)	Age (30-40years) N = 634 N (%)	Significance (p value)
Lipoprotein(a)	239 (29.65%)	224 (35.3%)	0.0255
Cholesterol	91 (11.3%)	165 (20.5%)	<0.0001
Triglyceride	24 (2.98%)	53 (8.36%)	<0.0001
HDL-C	263 (32.6%)	263 (41.5%)	<0.0001
LDL-C	95 (11.78%)	175 (27.6%)	<0.0001
LDL-C/HDL-C	148 (18.36%)	261 (41.17%)	<0.0001
TC/HDL- C	180 (22.3%)	302 (47.63%)	<0.0001
VLDL	43 (5.3%)	81 (12.77%)	<0.0001
Total Lipids	65 (8.1%)	116 (18.3%)	<0.0001

HDL-C: High Density Lipoprotein Cholesterol, LDL-C: Low Density Lipoprotein Cholesterol, TC: Total Cholesterol, VLDL: Very Low Density Lipoprotein

The distribution of dyslipidemias in individuals suffering from abnormally high levels of Lp (a) are shown in figure 1. The results indicated association of low HDL-C (33.7%) and high LDL-C (22%) with high Lp (a) in the studied population.

Figure 1: Prevalence of dyslipidemia in the population having high lipoprotein (a) level



HDL: High Density Lipoprotein, LDL: Low Density Lipoprotein, TC: Total Cholesterol, VLDL: Very Low Density Lipoprotein

Discussion :

Dyslipidemia involves those individuals who have faulty life style including sedentary habits, increased consumption of fatty foods, smoking, hypertension and diabetes and atherosclerosis starts at an early age in these individuals. [6] These empirical observations have been confirmed by Framingham studies. [7] However, most of the information on the

contributions of various lipid fractions to CVD risk is derived from studies in the Caucasian population and limited information exists regarding the changing time-trends in lipid levels and the prevalence of dyslipidemia in Indian subjects.

Gujaratis are the community bearing high burden of CVD risk factors especially disturbed lipid profile. [8] There are emergence of evidence indicating alarming high prevalence of morbidity and mortality associated with CVD in Gujarati population. [9] Though the prevalence of CHD in young is difficult to establish accurately due to "silent" nature of the process. [10] The early detection of risk factors often contribute significantly in the prevention/delaying of the event as it could be managed by life style modification. It is known that even though CAD is a fatal disease with no known cure, it is also highly predictable, preventable, and treatable with the existing knowledge.To the best of our knowledge none of the study has systematically evaluated the trend of lipid abnormalities in young and healthy Gujarati adults.

We have assessed prevalence of various lipids and lipoproteins using current definitions in young adults (20-40 years of age) of both the gender from Gujarati populations.Our results indicated alarmingly high levels of Lp (a) (32.15%) accompanied by low levels of HDL-C cholesterol (36.35%) in overall population, which is first time reported in this population.

The community based epidemiological studies often provide insight in the ethnic variation in the risk profile involved in cardiac diseases. [11] The common pattern of dyslipidemia seen in Asian Indians is higher levels of triglycerides, lower HDL-C levels, and higher levels of Lp(a). [12] In current study, we have observed two of the above mentioned abnormalities of Lp (a) and HDL-C, however the only slight elevation (5.35%) in the triglyceride level was observed, re-emphasizing the need of regional and ethnic dyslipidemia trend evaluation. This early onset of high-risk status, along with the high atherogenicity (10 times higher than LDL) and high thrombogenicity of Lp (a), appears to explain its strong association with premature coronary artery disease in this ethnic group. [13]

Several cross-sectional studies have demonstrated that lipid profile abnormalities are associated with age and gender, where females get fairer protection due to well-known premenopausal phenomena. [14] There is a delayed onset of CVD events by 10-15 years in females as compared to male. [15] The similar phenomena was observed in this study also as prevalence of conventional lipid (total cholesterol, triglyceride, HDL-C and LDL-C) abnormalities were significantly lower in females as compared to their male counterparts. However Lp (a), the novel risk factor of CVD having genetic link was found to be more prevalent in Gujarati females (35.66%vs 28.4%; p=0.0038).The strong correlation of serum Lp (a) levels with CAD in premenopausal women as reported by Maher and Brown adds significantly to our growing understanding of the importance of Lp (a) as a powerful risk factor for premature coronary artery disease in both sexes.[16] Earlier epidemiological studies have documented that Lp (a) levels are governed almost exclusively by race, ethnicity, and genetics, unlike other lipids, where the levels are influenced by age, gender, diet, and other environmental factors. [17-20] The stable lifelong levels of Lp (a) are attained in infancy, the pathological processes associated with elevated Lp(a) also begin in infancy (20 years earlier than other risk factors such as hypertension, cigarette smoking, and diet-related dyslipidemias). [13] When high levels of Lp(a) were combined with other risk factors, such as hypertension, diabetes, cigarette smoking, hyperhomocystinemia, and/or a high ratio of TC/HDL-C, the relative odds for premature coronary artery disease (CAD) were increased by 3 to 122 fold depending on the number of risk factors present and their severity. [21,22]

This global phenomenon of prematurity and severity suggests that CVD starts at an early age and has a malignant course. [13] In the present study also the age related changes in lipid profile are noted in Gujarati population. Our results indicates that natural ageing contributes significantly in the development of dyslipidemia and is being identified as one of the risk factor of CVD by various epidemiological studies. [23, 24] The positive relationship between conventional dyslipidemia in patients of CVD and their children

had been established earlier showing that lipid abnormalities in children indeed contribute to adult CVD. [25, 26]

Conclusion :

The genetic predisposition for CAD in Gujarati population could be partly explained by the early onset of several dyslipidemia and by high prevalence of Lp (a) abnormalities. This information could be used for designing of preventive strategies for dyslipidemias in this ethnic group of individuals.

Acknowledgement :

The authors express their sincere thanks to the Director, Dr. R. K. Patel and the research department of the institute for their continuous support in the completion of this project.

References :

1. Yusuf S, Reddy S, , Anand S. Global burden of cardiovascular diseases: Part II: variations in cardiovascular disease by specific ethnic groups and geographic regions and prevention strategies. Circulation 2001;4: 2855-64.
2. Enas A, Annamalai S, Chacko V, Neal P. Dyslipidaemia among Indo-Asians strategies for identification and management. Br J of Diabetes and Vascular Medicine 2005; 5:81-90.
3. Joshi P, Islam S, Pais P, Reddy S, Dorairaj P, Kazmi K, Pandey MR, Haque S, Mendis S, Rangarajan S, Yusuf S. Risk factors for early myocardial infarction in South Asians compared with individuals in other countries. JAMA 2007;297:286-94.
4. Gupta R, Guptha S, Joshi R, Xavier D. Translating evidence into policy for cardiovascular disease control in India. Health Res Policy Syst 2011; 9:8.
5. Enas EA, Chacko V, Pazhoor SG, Chennikkara H, Devarapalli HP. Dyslipidemia in South Asian patients. CurrAtheroscler Rep 2007; 9:367-74.
6. Noeman A, Ahmad N, Azhar M. Coronary artery disease in young: faulty life style or heredofamilial or both. Annals 2007; 13: 162-64.
7. Kannel WB. Risk stratification of dyslipidemia: insights from the Framingham Study. Curr Med ChemCardiovascHematol Agents 2005; 3:187-93.
8. Jayesh Prajapati, Sharad Jain, Kapil Virpariya, Jayesh Rawal, Hasit Joshi, Kamal Sharma, Bhavesh Roy, Ashok Thakkar. Novel Atherosclerotic Risk Factors and Angiographic Profile of Young Gujarati Patients with Acute Coronary Syndrome. JAPI 2014; 62; 584-88.
9. Trivedi DH, Sharma V, Pandya H, Arya RK, Mehta R, Bansal RK, Sharma A, Gandhi SP. Longitudinal epidemiological study of coronary heart disease in a rural population of Kheda district, Gujarat, India. SozPraventivmed 1996;41: 373-79.
10. Mouratidis B, Vaughan-Neil EF, Gilday DL, Ash JM, Cullen-Dean G, McIntyre S, MacMillan JH, Rose V. Detection of silent coronary artery disease in adolescents and young adults with familial hypercholesterolemia by single-photon emission computed tomography thallium-201 scanning. Am J Cardiol 1992; 70:1109-12.
11. Kurian AK, Cardarelli KM. Racial and ethnic differences in cardiovascular disease risk factors: a systematic review. Ethn Dis 2007; 17:143-52.
12. A Misra, KalpanaLuthra, NK Vikram. Dyslipidemia in Asian Indians: Determinants and Significance. JAPI 2004; 52; 137-42.
13. Enas EA, Mehta J. Malignant coronary artery disease in young Asian Indians: thoughts on pathogenesis, prevention and therapy. ClinCardiol1995;18: 131–35.
14. Ferdinand KC. Ethnic, gender, and age-related differences in the treatment of dyslipidemia. Am J Manag Care 2006;12: S400-4.
15. Rossouw JE. Hormones, genetic factors, and gender differences in cardiovascular disease. 2002: 53:550-7.
16. Maher VMG, Brown BG. Lipoprotein (a) and coronary artery disease. CurrOpinLipidol 1995; 6:229–35.
17. Wang W, Hu D, Lee ET, et al. Lipoprotein (a) in American Indians is low and not independently associated with cardiovascular disease. The Strong Heart Study. Ann Epidemiol 2002; 12: 107-14.
18. Howard BV, Le NA, Belcher JD, et al. Concentrations of Lp(a) in black and white young adults: relations to risk factors for cardiovascular disease. Ann Epidemiol 1994;4: 341-50.
19. Anand S, Enas EA, Pogue J, Haffner S, Pearson T, Yousuf S. Elevated lipoprotein (a) levels in South Asians in North America. Metabolism 1998; 47:182–184.
20. Haffner SM, Gruber KK, Morales PA, Hazuda HP, Valdez RA, Mitchell BD, Stern MP. Lipoprotein (a) concentrations in Mexican-Americans and non-hispanic whites: The San Antonio heart study. Am J Epidemiol 1992; 136: 1060–68.
21. Hopkins PN, Wu LL, Hunt SC, et al. Lipoprotein(a) interactions with lipid and nonlipid risk factors in early familial coronary artery disease. ArteriosclerThrombVascBiol 1997; 17:2783-92.
22. Von Eckardstein A, Schulte H, Cullen P, et al. Lipoprotein (a) further increases the risk of coronary events in men with high global cardiovascular risk. J Am CollCardiol 2001; 37:434-9.
23. Niccoli T, Partridge L. Ageing as a risk factor for disease. CurrBiol 2012; 11; 22:R741-52.
24. Brian J North, David A Sinclair. The Intersection between Aging and Cardiovascular Disease. Circulation Research 2012; 110: 1097-08.
25. Isser HS, Puri VK, Narain VS, Saran RK, Dwivedi SK, Singh S. Lipoprotein (a) and lipid levels in young patients with myocardial infarction and their first degree relatives. Indian Heart J 2001; 53:463–6.
26. Mohan V, Deepa R, Rani SS, Premalatha G. Chennai Urban Population Study (CUPS No.5). Prevalence of coronary artery disease and its relationship to lipids in a selected population in South India: The Chennai urban population study (CUPS No. 5) J Am CollCardiol 2001; 38:682–7.