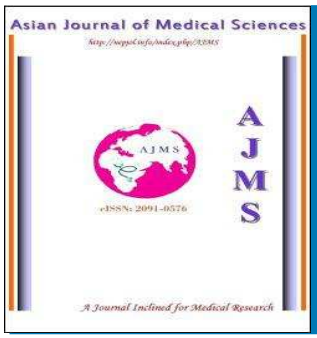

DYSLIPIDEMIA AND ITS RELATIONSHIP WITH CARDIOVASCULAR RISK FACTORS IN A SELECTED POPULATION OF SILIGURI CITY, WEST BENGAL, INDIA

ORIGINAL ARTICLE,Vol-5 No.1

Asian Journal of Medical Science, Volume-5(2014) http://nepjol.info/index.php/AJMS

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"Dyslipidemia in a selected population of Siliguri city, India."

ABSTRACT

Background:
Dyslipidemia, one of the classical Framingham risk factors of cardiovascular diseases, accounts significantly to the rise of non communicable diseases in India. Urbanization, along with greater consumption of dietary fats and decreased physical activity, has led to an increase in this problem manifold.

Objectives: To determine the prevalence of dyslipidemia among urban adults of Siliguri city, West Bengal and to identify the cardio-vascular risk factors associated with it.

Methods: This descriptive, cross-sectional study was carried out among the 226 adults aged ≥20yrs in an urban area of Siliguri city, West Bengal, India. Data was collected by detailed history and physical examination; biochemical measurements were done using standards procedures. Dyslipidemia was defined by the presence of one or more than one abnormal serum lipid concentration. Statistical analysis was done using chi-square test, t test and logistic regression analysis using SPSS 20 software (Chicago, IL, USA).

Results: Dyslipidemia was prevalent among 78.4 % of the total study subjects. Dyslipidemia was more in males than in females & in both males and females it was more prevalent in the age group 40 -59 years than in any other age group. It was associated with higher odds of major cardiovascular risk factors like hypertension, hyperglycemias, and tobacco use.

Conclusion: Dyslipidemia remains a significant and growing problem in this part of the country. The reduction in the disease burden will require changes in life style as well as in national policies.

Keywords: Dyslipidemia, urban, adults, risk factor, cardiovascular disease, West Bengal.

INTRODUCTION

World wide, half of all adult mortality (and extensive severe disability) is caused by vascular diseases and most of these deaths involve coronary heart disease and stroke.[1] Most of those persons who die of these conditions are still in middle age; when they die, losing about 20years of life expectancy. [2] Of the 57 million global deaths in 2008, 36 million, or 63%, were due to non communicable diseases (NCDs), principally cardiovascular diseases, diabetes, cancers and chronic respiratory diseases. [3]

India, the second most populous nation in the world, is experiencing a rapid health transition with a rising burden of non communicable diseases. Overall, NCDs represent the lion's share of India's disease burden and are emerging as the leading cause of deaths in India, accounting for over 42% of all deaths.[4] Non-communicable diseases accounted for 40% of all hospital stays and 35% of all outpatient visits in 2004.[5]

Cardiovascular disease (CVD), an important NCD, has a multifactorial etiology with a number of potentially modifiable risk factors. The classical Framingham risk factors, age, sex, cigarette smoking, blood pressure, increase in total to high-density lipoprotein cholesterol ratio have proved consistent risk factors in every population studied.[6] A case control study by Kumar et al reported significantly higher total cholesterol and triglyceride levels and lower high density lipoprotein cholesterol (HDL-C) levels in patients admitted with acute myocardial infarction.[7]

Blood cholesterol has a log–linear relationship to the risk of cardiovascular disease and is estimated that in high-income countries blood cholesterol levels in excess of 3.8 mmol/litre are responsible for more than 50% of CVD events.[8]

Limited information exists regarding the changing time-trends in lipid levels and the prevalence of dyslipidaemia in Indian subjects. ICMR study reported 36.8% and 39.8% prevalence of hypercholesterolemia in the urban Delhi and rural Haryana respectively during 1991-94.[9]

Social and individual changes that accompany urbanization clearly play a role because plasma cholesterol levels tend to be higher among urban residents than among rural residents. This shift is largely driven by greater consumption of dietary fats—primarily from animal products and processed vegetable oils—and decreased physical activity.[10] This forms a background for undertaking a study with the objectives to determine the prevalence of dyslipidemia among urban adults of Siliguri city, West Bengal and to identify the cardio-vascular risk factors associated with it.

MATERIALS AND METHODS

The Third Report of the National Cholesterol Education Program(NCEP) in Adults suggests that in all adults aged 20 years or older, a fasting lipoprotein profile should be obtained once every 5 years as a method of primary prevention of cardio-vascular risk reduction and identification of accompanying risk determinants.[11] In this context, the present descriptive, cross-sectional study was carried out among the adults aged 20yrs or older from July to October 2011 residing in Dabgram ward under Siliguri Municipal Corporation area, which is the urban field practice area of North Bengal Medical College.

A sample size of 273 was calculated by using prevalence of dyslipidemia among the urban population in India as 36.8%,[9] absolute allowable error as 6%, confidence level 95% and a non-response rate of 10%. From the updated electoral list of Dabgram ward under Siliguri Municipal Corporation area, a sampling frame of eligible study population i.e.,age ≥ 20yrs and permanent resident of that locality was prepared. The people who did not give consent and who were very sick were excluded. Furthermore, individuals with pre-existing cardiovascular disease, individuals with prescribed lipid therapy, or hormone replacement therapy were also excluded from the study. The adequate sample size was recruited by using systematic random sampling design.

The patients thus selected were visited at their respective homes and the purpose of the study was explained to them. They were requested to the visit urban health training centre (UHTC) on pre- specified dates for blood testing after an overnight fast for 12 hours.

At the UHTC, necessary data were collected from the subject after obtaining informed consent using a pre-tested, semi-structured validated questionnaire which

included history of cardiovascular risk factors like smoking, alcohol consumption, and family history of cardio-vascular disease, hypertension and diabetes. By initial translation (from English to the local vernacular Bengali), back-translation and retranslation, followed by a pilot study the questionnaire was validated. The physical examination included height, weight and blood pressure measurement as per WHO standard guidelines. [12] Body mass index (BMI) was computed as weight in kg/meter^2. A maximum of three visits were conducted for those individuals who could not be contacted during first visit.

Blood sample was collected by venepuncture in plain and fluoride bulb for measurement of serum lipid and glucose respectively. The level of serum glucose, total cholesterol, triglyceride, were measured by Erba CHEM-5 Plus V_2 auto-analyzer in the Department of Biochemistry, North Bengal Medical College.

- Total Cholesterol(TC) of the serum was estimated by enzymatic (ester hydrolase) method.[13]
- Triglyceride(TG) level was measured by using Enzymatic Glycerol Phosphate Oxidase/ Peroxidase method.[14]
- Serum high density lipoprotein cholesterol(HDL-C) was estimated by iso electric precipitation technique.[15]
- Low density lipoprotein Cholesterol (LDL-C) values in mg/dl were calculated by the formula of Friedewald et al.[16]
- Plasma glucose was estimated by using glucose oxidase-peroxidase (GOD-POD) system.[17]

Data were computer-coded and analyzed using the statistical package (Chicago, IL, USA). Continuous variables were expressed as mean value ± standard deviation. Categorical variable, as frequencies, were compared between groups using the Chi-square as appropriate statistical test. A p value of <0.05 was considered to be statistically significant. Binary logistic regression analysis was used for statistical analysis dyslipidemia was used as the dependent variable, where having dyslipidemia was coded as 1 and not having as 0. The independent variables used for the analysis included age , addiction to tobacco, family history of CVD, hypertension (≥140/90 mm of Hg), age, hyperglycemia and BMI ≥25kg/m^2.

For serum lipid reference level, National Cholesterol Education Programme (NCEP) Adult Treatment Panel III (ATP III) guideline was referred.[11] According to NCEP-ATPIII guideline, hypercholesterelemia is defined as total cholesterol>200 mg/dl, high LDL-C when value >100 mg/dl, hypertriglyceridemia as TG >150 mg/dl and low HDL-C when value <40 mg/dl. Dyslipidemia was defined by presence of one or more than one abnormal serum lipid concentrations.[18]

Age was defined as a risk factor in men >45 years and women >55 years.[11] Addiction to tobacco was defined as smoking cigarettes, bidis or using chewable products like gutka, khaini or zardapaan daily. Hyperglycaemia was defined as per American Diabetes Association (ADA) criteria as having fasting blood sugar >100 mg/dl.[19] A BMI of >25 kg/m^2 was considered as a risk factor. Hypertension was diagnosed when the systolic blood pressure was 140 mmHg or more and the diastolic blood pressure was 90 mmHg or more, as per US JNC-7 report or the patient was on hypertensive medication.[20] Family history of Coronary heart disease was defined as history of pre-mature CHD in first degree relatives (CHD in male first-degree relative, 55 years; CHD in female first-degree relative, 65 years)

Ethical issues: Ethical clearance was sought from the Institutional Ethics Committee. Informed consent was obtained from the participants prior to the study after ensuring confidentiality and anonymity.

RESULTS

Among the 273 subjects contacted at their home, finally data was available from 226 participants who attended the UHTC for blood collection. Among them, there were 109 (48.2%) males and 117 (51.8%) females with the mean age of males as 46.97 ± 12.14 yrs and 42.96 ± 12.67 yrs in females. There were no significant differences between males and females with reference to clinical and biochemical characteristics except addiction to tobacco. (Table I) The prevalence of hypercholesterolemia (13.%), hypertriglyceridemia (21.3%) and abnormally high LDL cholesterol (27%) was the highest among males of 40-59 yrs. Similar trend was

seen in females except low HDL cholesterol which shows higher prevalence (27%) in 20-39 yrs age group. The prevalence of high LDL-C (29.2%), low HDL-C (29.6%), and hyper tri-glyceridemia (19.0%) was more in females. On the basis of NECP (ATP III) criteria dyslipidemia was observed among 77.9% of the total study subjects; 84.4% in males and 71.8% in females (not shown in table). The dyslipidemia was observed more in 40-59 yrs age group in both males & females, 87.9% & 82.2% respectively. It was followed by 20-40yrs & ± 60yrs in both males & females. (Table II).

Table III shows logistic regression analysis with dyslipidemia as the dependant variable and major risk factors as the independent variables. It was found that increased odds of dyslipidemia were associated with major cardiovascular risk factors like addiction to tobacco, hypertension and hyperglycemia.

DISCUSSION

In the present study, 226 adults of both sexes consented to participate and were screened for lipid abnormalities. The overall mean levels of TC, TG, LDL-C, HDL-C (mg/dl) were 171.4±114.99, 136.9±53.62, 94.4±98.13, 38.5±15.62 respectively which were within the normal limits. Similar findings were reported by Gupta et al in their study done in cohorts of male population in Rajasthan.[21] In the present study, the means of plasma lipids except TG were higher in females than in males which were concordant with the findings of the studies among the urban adults of Mumbai[22] & Trabzon Region of Turkey[23].

As per NCEP-ATPIII guidelines, in the preset study, it was revealed that 78.4% of study population was dyslipidemic and it was more in males (84.4%) than in females (71.8%). Applying the same criteria Sawant et al reported 80% abnormal parameters in his study population with a higher prevalence in males. [22] In a similar study done in Warangal district of Andhra Pradesh, dyslipidemia was reported in 52.7% of males and 42.9% of females[24] and the Trabzon Lipid study in Turkey also led to the same observation.[23] The prevalence of dyslipidemia in our study population was high indicating high risk of CVD. This was consistent with the study done among young adults in Izmir, Turkey [25] and in urban dwellers of Mumbai.[22]

The higher prevalence of dyslipidemia in the current study may be explained in the context of rapid urbanization, change of dietary habits and decreased physical activity. Besides it also involves overcooking of food which results in destruction of nutrients like folate, by deep frying and refrying in the same oil leading to trans fatty acids formation which probably contribute to increase dyslipidemia.[26] The World Health Organization estimates that 60% of world's cardiac patients would be Indian by 2010.[27]

Increased prevalence of high LDL-C (47.8%) and low HDL-C (47.3%) were the major abnormalities found in the present study followed by TG (31.9%) lastly by TC (16.4%). Pongchaiyakul C[28] reported the prevalence of hypercholesterolemia, hypertriglyceridemia. high LDL-C and low HDL-C to be 31.0, 40.0, 20.0 and 14.0 per cent respectively. In a multi centric study by Kumar et al, ratio of TC/HDL-C, TG/HDL-C and LDL-C/HDL-C was observed higher in acute myocardial infarct patients as compared with controls and were suggested as potential risk factors.[29] Gordon et al. showed that low HDL-C is a risk factor for coronary heart disease in the Framingham study.[30] Pongchaiyakul et al[28] also found women had 2 to 3.5-fold higher prevalence of hypercholesterolemia and high LDL-C than men. In the study of Sawant et al,[22] abnormal low HDL-C was found in 64.2% males and 33.8% females among urban dwellers of Mumbai. According to Wang et al[31] increased level of low HDLC has increased over past 20 years. Oxidative modification of LDL-C is a key process of atherosclerosis & elevated LDL-C has been recognized as a factor for CVD.

The maximum prevalence was found in 40-59 yrs of age group in both sexes. Among the adults of Trabzon region of Turkey prevalence of hypercholesterolemia, elevated LDL-C, low HDL-C, hyper triglyceridemia were 37.5%, 44.5%, 21.1% and 30.4% respectively.[23] This study also reported hypercholesterolemia, hyper triglyceridemia, more in males and more prominent in 31-40 yrs than in ≤30 yrs of age group. Increased prevalence of dyslipidemia was higher in middle age group (40-59 yrs, >39%) & even higher in older age

Table I: Distribution of socio demographic and clinical characteristics of the study population of Siliguri city

Clinical & biochemical characteristics	Male (n=109)	Female (n=117)	Total (n=226)	F/ χ^2 value (p value)
Age (in years)	46.97 ±12.14	42.96 ±12.67	44.89 ± 12.55	2.429 (0.16)
BMI (kg/m2)	20.55 ± 3.51	21.64 ± 5.03	21.12 ± 4.38	3.67 (0.06)
Fasting blood sugar (mg/dl)	84.96± 54.25	85.53 ± 36.03	85.26 ± 45.63	3.87 (0.93)
Diastolic BP in mm of Hg	78.52 ± 10.96	76.23 ± 10.89	120.30 ± 22.70	0.22 (0.12)
Systolic BP in mm of Hg	119.50 ± 21.47	121.03 ± 23.85	77.34 ± 10.96	1.52 (0.61)
Addiction to tobacco	68 (62.4%)	46 (39.3%)	114 (50.4%)	12.01 (0.01)
Family History of CHD	29 (26.6%)	36 (30.8%)	65 (28.8%)	0.477 (0.29)
Total Cholesterol (mg/dl)	168.0 ±48.04	174.5 ± 53.22	171.36 ± 114.99	-0.425 (0.66)
Serum triglycerides (mg/dl)	143.4 ±59.78	130.9 ± 46.62	136.91 ± 53.62	1.768 (0.08)
Serum HDL (mg/dl)	36.3 ±16.73	40.5 ± 14.29	38.45 ± 15.62	-2.010 (0.05)
Serum LDL (mg/dl)	88.5 ±34.07	98.5 ± 24.44	94.44 ± 98.13	-0.652 (0.52)

(>60yrs, 40.5% in males, 62% in female) observed by Estari et al.[24] High LDL-C and low HDL-C level are associated with an increased risk of CVD.

Coronary atherosclerosis is more likely to occur in patients with certain risk factors which include age, male gender, postmenopausal women, family history of CVD, diabetes, hypertension, tobacco smoking, high serum cholesterol & other associated lipoprotein abnormality.[32] The present study also revealed dyslipidemia to be associated with CVD risk factors like positive family history, addiction, hypertension, hyperglycemia & obesity and age. In a cross-sectional study by Gupta et al.[33] in rural Rajasthan, no correlation with BMI & dyslipidemia was seen where as Erem et al.[23] found significant association of blood pressure, fasting blood glucose, addiction and family history with dyslipidemia in urban population. A prospective data among Chinese male steel workers demonstrated that hypertension, cigarette smoking, overweight, hypercholesterolemia, are major risk factors for CVD.[34]

The limitations of our study must be considered. The number of subjects studied was small and they may not be representative of the general urban population of Siliguri. Because of the cross-sectional nature of the present study, the cause–effect relationship of our findings cannot be proven and a large scale, prospective study is required. Also, because the participation in the study was voluntary, the effect of bias cannot be ruled out.

CONCLUSION

Dyslipidemia remains a significant and growing problem in most of the developing regions of the world, including this part of the country, as highlighted in the present study. The increase in prevalence and mortality associated with it is a reflection of the epidemiological transition that has accompanied economic and social development. The reduction in the disease burden will require changes at the policy level as well as at the personal level. Further, involvement of health workers at the community level needs to be ensured to manage

Table II. Prevalence of dyslipidemia according to age and sex of the study populationof Siliguri city*

	Hypercholesterolemia	Hyper triglyceridemia	Low HDL-C	High LDL-C	Dyslipidemia
Male (n=89)					
20-40 yrs	4 (12.9%)	7 (22.6%)	23 (74.2%)	6 (19.4%)	25 (80.6%)
40-59 yrs	16 (27.6%)	26 (44.8%)	38 (65.5%)	8 (13.8%)	51 (87.9%)
≥ 60 yrs	4 (20.0%)	7 (35.0%)	12 (60.0%)	2 (10.0%)	16 (80.0%)
Females (n=137)					
20-39 yrs	5 (9.6%)	12 (23.1%)	23 (44.2%)	14 (26.9%)	33 (63.5%)
40-59 yrs	4 (8.9%)	16 (35.6%)	31 (68.9%)	10 (22.2%)	37 (82.2%)
≥ 60 yrs	2 (10.0%)	4 (20.0%)	11 (55.0%)	4 (20.0%)	14 (70.0%)

*Values expressed in N (percentages)

Table III: Risk assessment of dyslipidemia among study population of of Siliguri city using binary logistic regression analysis (N= 226)

Major Risk Factors	Dyslipidemia (%)	OR	95% CI		Total
Addiction to tobacco	97 (85.1%)	2.17	1.10	4.30	114 (100%)
Family History of CVD	46 (70.8%)	0.59	0.28	1.26	65 (100%)
Hypertension (≥140/90 mm of Hg)	49 (80.3%)	1.31	0.60	2.87	61 (100%)
Age and sex	68 (77.3%)	0.76	0.39	1.51	88 (100%)
Hyperglycemia	38 (77.6%)	1.06	0.46	2.47	49 (100%)
BMI ≥25kg/m^2	31 (72.1%)	0.84	0.36	1.96	43 (100%)
Total	176 (77.9%)				226 (100%)

such an important risk factor for chronic disease.

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Authors Contributions:

RB: Concept and Design of the study and data collection.

SB: Concept and Design of the study, analysis and interpretation, manuscript preparation, critical revision of the manuscript, data collection, statistical analysis, and literature search.

KR: Concept and Design of the study, analysis and interpretation, manuscript preparation, critical revision of the manuscript, statistical analysis, and literature search.

JKR: Concept and Design of the study and data collection.

SD: Concept and Design of the study and literature search.

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Conflict of Interest: None

Date of Submission: 24.8.2013
Date of Peer review: 25.8.2013
Date of submission of revised version: 26.8.2013
Date of peer review: 27.8.2013
Date of submission of final version: 27.8.2013
Date of Acceptance: 28.8.2013
Date of Publication: 9.9.2013