



Original Research Article

Prevalence of atherogenic dyslipidemia in young asymptomatic medical professionals of a Tertiary Care Hospital in South India: A cross-sectional study

R Amirtha Jansi Rani^{1,*}, P Deepa¹, R Shanthi¹

¹Dept. of Biochemistry, Government Stanley Medical College, Chennai, Tamil Nadu, India



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ABSTRACT

Atherogenic dyslipidemia is a condition characterised by an elevation of triglycerides and small-dense low-density lipoprotein (sdLDL) and a reduction in high-density lipoprotein cholesterol (HDL Cholesterol). Prevalence studies from India is less and are of small scale in nature. There are no studies among medical and paramedical professionals that document the prevalence of dyslipidemia in India. In order to determine the prevalence of dyslipidemia in young asymptomatic medical and paramedical professionals, the following study was done with lipid profile and with Atherogenic Index of plasma (AIP), Castelli's Risk Ratio I&II (CRR I&II). From May 2016 to August 2016, a cross-sectional study was done among medical and paramedical professionals (N=120) aged between 18-40 years working in a tertiary care hospital. Fasting and post prandial blood sugar, total cholesterol, triglycerides, high density lipoprotein, low density lipoprotein, atherogenic ratios and BMI were calculated. Among the 120 participants (80 doctors; 40 nurses), 43(35.8%) were males and 77(64.1%) were females. Out of 120 participants, 79 (65.8%) had BMI within the normal range, 37 (30.8%) had BMI 25-30 and 4 (3.4%) of them had BMI 30-35. Atherogenic dyslipidemia is a potent marker of coronary artery disease risk, especially among asymptomatic young individuals. Indices for coronary risk assessment are more potent than lipid profile. They can be used as effective screening tool in clinical settings and epidemiological studies. Young individuals engaged in white collar jobs must be screened for atherogenic dyslipidemia from an early age to prevent coronary artery disease.

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1. Introduction

Atherogenic dyslipidemia is a condition characterised by an elevation of triglycerides and small-dense low-density lipoprotein (sdLDL) and a reduction in high-density lipoprotein cholesterol (HDL Cholesterol).¹ The term dyslipidemia differs from hyperlipidaemia, in that dyslipidemia refers to the derangement of one or more lipoproteins like elevated total cholesterol, LDL-cholesterol and triglycerides, or lowering of HDL cholesterol as per National Cholesterol Education Program Adult Treatment Plan III (NCEP ATP III), whereas mere elevation of lipoproteins is labelled as 'hyperlipidaemia'.²⁻⁴ Dyslipidemia may result from either over-production or lack

of clearance of the lipoprotein particles in plasma, or may be related to defects in the apolipoprotein metabolism due to metabolic pathway enzyme deficiencies. It is a proven risk factor in cardiovascular diseases.^{5,6} Dyslipidemia has been identified as one of the most important risk factor for CAD (Coronary Artery Disease) by the INTERHEART-South Asia study.⁷

Prevalence studies from Heart SCORE and India SCORE shows there are population variations in Atherogenic dyslipidemia with an increased prevalence of small-dense LDL and TG/HDL ratio>3 among Asian Indians.⁸ Review studies in India show a prevalence of dyslipidemia between 10 to 73%.⁴ Urban professionals with sedentary lifestyle had higher prevalence.⁹ Less physical activity and high carbohydrate diet with low polyunsaturated fatty acid (PUFA) is attributed to this.^{8,10} Prevalence studies from India is less

* Corresponding author.

E-mail address: jansirajan001@gmail.com (R. A. J. Rani).

and are of small scale in nature. There are no studies among medical and paramedical professionals that documents the prevalence of dyslipidemia in India.

In order to determine the prevalence of dyslipidemia in young asymptomatic medical and paramedical professionals, the following study was done with lipid profile and with Atherogenic Index of plasma (AIP), Castelli's Risk Ratio I&II (CRR I&II).

2. Materials and Methods

From May 2016 to August 2016, a cross-sectional study was done among medical and paramedical professionals (N=120) aged between 18-40 years working in a tertiary care hospital to study the prevalence of dyslipidemia among young asymptomatic medical and paramedical professionals. Institutional ethics committee approval was obtained and participants were recruited for the study after obtaining written informed consent. Individuals having Diabetes, Hypertension, Dyslipidemia, smoking, alcoholism Hypothyroidism, any chronic illness, and treatment for any metabolic disorders were excluded. Anthropometric readings like height, weight Body Mass index (BMI) and Waist/Hip ratio were calculated based on WHO classification and Dr. Chadha's anthropometric correlation study.¹¹

Blood collection was done under universal aseptic precautions, after an overnight fast for 8-12 hours. About 5ml of blood was drawn from the ante-cubital vein and transferred into red topped serum tubes. The blood samples were analysed on the same day within few hours of blood collection.

The biochemical parameters relevant to the study were analysed by the following methodologies.

2.1. Investigations

2.1.1. Fasting and post prandial blood sugar

Blood glucose estimated using GOD-POD principle in random access fully automated chemistry analyzer.

2.1.2. Total cholesterol

Total cholesterol was done in fasting serum sample using enzymatic method in fully automated chemistry analyzer.

2.1.3. Triglycerides

Enzymatic method was used for estimating Triglycerides.

2.1.4. High density lipoprotein

Estimated by Direct (homogenous) measurement method in random access fully automated chemistry analyzer.

2.1.5. Low density lipoprotein

Calculated using Friedwald's formula.

2.1.6. Atherogenic ratios calculation

Atherogenic Index of Plasma (AIP) = $\log \text{ TG/HDLc}$.

Castelli's Risk Index (CRI-I) = TC/HDLc .

Castelli's Risk Index (CRI-II) = LDLc / HDLc .

2.2. Definitions and preferred cut-off values

For serum lipids, we referred to NCEP - ATP III Guidelines. According to these standard guidelines, hypercholesterolemia is defined as $\text{TC} > 200\text{mg/dL}$, LDL-C as $> 100\text{mg/dL}$, hypertriglyceridemia as $\text{TG} > 150\text{mg/dL}$ and HDL-C $< 40\text{mg/dL}$. Dyslipidemia is defined as the presence of one or more than one abnormal serum lipid concentration. For serum Glucose levels, we referred to ADA Guidelines. Persons with fasting blood glucose $> 126\text{mg/dl}$ or who were on medication for diabetes was considered as having diabetes mellitus.^{2,12} BMI cut-off of 18.5-24.9 was taken as normal. AIP risk cut-off is low risk < 0.1 , medium risk $0.1 - 0.24$ and high risk > 0.24 . The Atherogenic Indices of the study population namely AIP, CRR I & II has been categorized as per Misra et al.⁴

3. Results

This study included 80 doctors and 40 nurses. Fasting and post prandial blood glucose was performed and diabetes was ruled out for all participants before commencement of the study. Among the 120 participants, 43(35.8%) were males and 77(64.1%) were females. Out of 120 participants, 79 (65.8%) had BMI within the normal range, 37 (30.8%) had BMI 25-30 and 4 (3.4%) of them had BMI 30-35. Table 1 shows the distribution of dyslipidemia among the participants. Table 2 shows the prevalence of atherogenic risk based on coronary risk indices. Around 51.6% (n=62) of participants had Waist/Hip (W/H) ratio > 0.9 , in which males were 34.1% (n=41) and females were 17.5% (n=21). W/H ratio was noted to be higher in males than females. Lipid profile reveals only the presence of dyslipidemic changes, but atherogenic dyslipidemic changes are predicted by better sensitive indices like AIP, CRR I & II.

4. Discussion

Non-communicable diseases are gradually increasing among Indians.¹³ There has been an increased morbidity and mortality due to non-communicable diseases in India.¹⁴ Coronary artery disease constitutes the majority of the mortality and morbidity of these non-communicable diseases.^{15,16} A number of risk factors either directly or indirectly leads to the origin, development and progression of coronary artery disease.¹⁷⁻¹⁹ These risk factors differ between age groups, socioeconomic status and nature of job.²⁰ Therefore, the risk of having coronary artery disease in one's life time can be predicted using these factors.^{21,22} Dyslipidemia is a significant predictor of coronary artery disease in asymptomatic healthy individuals.^{2,23} Scientific

Table 1: Distribution of dyslipidemia among 120 participants

S.No	Type of Dyslipidemia	Prevalence Percentage	No. of Individuals
1.	Hypercholesterolemia	5%	6
2.	Hypertriglyceridemia	10.8%	12
3.	High LDL-cholesterol	36.6%	44
4.	Low HDL-cholesterol	50.8%	60

Table 2: Prevalence of atherogenic risk based on coronary risk indices

Index	Risk Stratification		
AIP (LogTGL/HDL)	Low Risk (<0.1) 4 (3.3%)	Medium Risk (0.1-0.24) 20 (16.6%)	High Risk (>0.24) 96 (80%)
CRR I (TC/HDL)	Low Risk 69 (57.5%)		High Risk 51 (42.5%)
CRR II (LDH/HDL)	Low Risk 104 (86.6%)		High Risk 16 (13.3%)

evidences prove the strong association between incidence of CAD with atherogenic dyslipidemia (high level of LDL-c and low level of HDL-c).^{24,25}

Dyslipidemia may result from either over-production or lack of clearance of the lipoprotein particles in plasma, or may be related to defects in the apolipoprotein metabolism due to metabolic pathway enzyme deficiencies. Dyslipidemia is of two types; primary- due to genetic defects which are non-modifiable and not treatable, secondary - which are modifiable and treatable. Atherogenic lipoprotein phenotype is a dyslipidemic pattern which consists of hypertriglyceridemia, increased small-dense LDL particles, and low HDL-cholesterol levels. Very low density lipoprotein (VLDL) on its metabolic journey, exchanges triglycerides for cholesterol ester with LDL by the action of the enzyme cholesterol ester transfer protein (CETP), and the LDL becomes triglyceride rich lipoprotein. Further, the triglyceride in LDL is hydrolysed by lipoprotein lipase or hepatic lipase resulting in a smaller denser LDL (Sd LDL-C) particle. Thus, increased VLDL secretion results in increased generation of small-dense LDL particles, particularly when serum triglyceride concentrations are >1.5 mmol/L (132.85 mg/dL).^{26–28} High levels of small dense LDL promote atherogenesis by the following mechanisms: a) rapid infiltration into the arterial wall than the normal-sized LDL b) increased susceptibility to retention in the extracellular matrix and c) increased oxidation.^{5,29} Low levels of HDL cholesterol are often caused by the core lipid exchange, as well as accelerated clearance of HDL particles, which explains the frequent combined occurrence of hypertriglyceridemia and low HDL-cholesterol levels. Individuals with abnormal fat distribution, characterized by a high waist-to-hip ratio or high truncal subcutaneous fat are predisposed to develop insulin resistance and dyslipidemia.^{30,31} This body composition is commonly seen in Asian Indians.^{32–35} Patients with upper trunk obesity were found to have higher levels of non-esterified fatty acids (NEFAs) than

patients with lower body obesity. This excess NEFA leads to hepatic steatosis and increased VLDL output from liver, thereby increasing the concentration of small-dense LDL and reduced HDL-c.⁴

Prevalence studies on atherogenic dyslipidemia are very less in India. In this study, the prevalence was higher than the previous studies. Female participants were more than males and the dyslipidemic changes with coronary risk were also observed more in females than in males. BMI being a good indicator of total body adiposity reflects the underlying dyslipidemic changes as explained early. In this study, 41 (34.8%) participants were with BMI > 25, most of them were females. Inadequate physical activities among the medical professionals, in addition to obese ethnicity in young Indian women, could be the probable explanation for the higher prevalence of obesity in this study population. Intake of calorie rich diet and lack of exercise as a part of modern lifestyle causes truncal adiposity and highly predisposes to dyslipidemia and insulin resistance. Waist to Hip (W/H) circumference ratio is a better indicator of central obesity than BMI. The cut off was taken as 0.9 from Dr. D S Chadha et al study on anthropometry. In the present study, 51.6% (62) of participants had W/H ratio >0.9, in which males were 34.1% (41) and females were 17.5% (21).¹¹ W/H ratio was noted to be higher in males than females. Fasting and post prandial blood glucose was performed and the diabetes was ruled out for all participants before commencement of the study.

Dyslipidemia observed with fasting lipid profile for all the participants were measured. A combined lipid derangement was observed in most of the individuals but not in all four parameters in the same person (TC, TGL, LDL-c & HDL-c). Hypercholesterolemia was noted only for six participants while hypertriglyceridemia and low HDL-c was found to be higher in females. Hypertriglyceridemia with low HDL-c has twofold increased risk of CAD which was observed in this study population.³⁶ As explained earlier, adiposity leading to increased VLDL output from the liver

and rapid core lipid exchange could be the justified cause for combined hypertriglyceridemia and low HDL-c.

The Framingham heart study over years, has established the role of deranged lipid profile in the progression of CAD and correcting the LDL-c levels as the primary target for treatment. It is not the serum lipid profile alone that rules out the coronary artery disease, atherogenic dyslipidemia should be estimated and sensitive indices for coronary risk assessment like Atherogenic Index of Plasma, Castelle's Risk Ratio I & II should be calculated. This includes Total Cholesterol, LDL-c, HDL-c and their ratios which in turn are individual risk predictors.^{37–39} In this study, AIP index showed that 3.3% (n=4) had low risk, 16.6% (n=20) had medium risk and 80% (n=96) had high risk for CAD. This is similar to the published literature.⁴⁰ Out of 120 participants, 42.5% (n=51) and 13.3% (n=16) had high risk for CRR-I and CRR-II respectively. The present study and the reference study emphasises that, it is the ratio of bad cholesterol to good cholesterol that predicts the coronary artery disease risk rather than the lipid profile alone in an individual. Taking the ratios alone into consideration, the risk of developing coronary artery disease is in high percentage among young medical and paramedical professionals than the expected level.

5. Conclusion

Atherogenic dyslipidemia is a potent marker of coronary artery disease risk, especially among asymptomatic young individuals. Indices for coronary risk assessment like Atherogenic Index of Plasma, Castelle's Risk Ratio I & II are more potent and can be used as effective screening tool in clinical settings and epidemiological studies. Young individuals engaged in white collar jobs must be considered for regular screening from an early age to prevent coronary artery disease. Future studies should focus on replicating the present study at a larger scale.

6. Source of Funding

None.

7. Conflict of Interest

None.

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Author biography

R Amirtha Jansi Rani Assistant Professor

P Deepa Assistant Professor

R Shanthi Associate Professor

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