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Original Research Paper

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LIFESTYLE INDUCED OXIDATIVE STRESS AMONG DYSLIPIDEMIC SUBJECTS AND ITS RISK FOR PREHYPERTENSION

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ABSTRACT Dyslipidemia is a high level of lipids (cholesterol, triglycerides, or both) carried by lipoproteins in the blood. Oxidative stress is underling cause for the development of dyslipidemia and cardiovascular disease. Prehypertension has been recently described as an independent category of blood pressure. Mounting evidence suggests that blood pressure in the prehypertensive range is associated with an increased risk of developing hypertension and cardiovascular disease. Several reports have assigned a critical role for oxidative stress in these disease processes. Lifestyle behaviors such as alcohol consumption, smoking and stress have been associated with change in lipid metabolism and thereby increase in oxidative stress levels. The aim of the present study was to evaluate lifestyle induced oxidative stress by measuring the levels of lipid peroxidation as malondialdehyde (MDA) along with lipid profile among dyslipidemic subjects and its risk for prehypertension. Present study consists of 46 study subjects and 17 control subjects. The levels of lipid profile were significantly altered in the study subjects. Levels of MDA were significantly increased in study subjects than control subjects. These results provide some evidence regarding the role of increased reactive oxygen species and decreased antioxidant activity in subjects. Lifestyle modification along with physical activity, improved diet and antioxidant therapy can reduce the risk of prehypertension.

KEYWORDS : Dyslipidemia, Cardiovascular disease, Oxidative stress and Malondialdehyde, Prehypertension

INTRODUCTION

Dyslipidemia is a condition of abnormal lipid level (cholesterol or fat) in blood. It refers to an abnormality with the lipid profile, encompassing a variety of disorders relating to elevations in total cholestrol, LDL or TG, or conversely, low level of HDL. Dyslipidemia may represent as a single disorder affecting only one lipoprotein parameter or may represent a combination of lipoprotein abnormalities, such as elevated TG and low HDL (Knut Broch and Johnsen, 2007). Dyslipidemia comes under consideration in many situations including diabetes, a common cause of dyslipidemia. Dyslipidemia means an abnormal amount of lipids, or fats, in the blood. Lipids are essential to life, but excess of certain lipids can increase the risk for cardiovascular disease. An atherogenic dyslipidemia is an integral component of metabolic syndrome and also seen in patients with obesity, insulin resistance, and type 2 diabetes mellitus (Kathiresan et al., 2006). According to Sawant et al., (2008) the increase in prevalence of hypercholesterolemia and hypertriglyceridemia was more prominent in 31-40 years age group and is a causal factor of early atherosclerosis and premature cardiovascular diseases (CVD). Adverse lifestyle behaviors such as alcohol consumption, smoking and a stressful lifestyle have been associated with a change in lipid metabolism and thereby increase in oxidative stress levels (Black, 2002). Obesity and dyslipidemia are strongly associated with the formation of reactive oxygen species. Significantly higher intake of total fat and saturated fatty acids stimulates ROS production that is jointly up regulated in the liver and adipose tissue (Jarosz, 2008).

Prehypertension has been recently described as an independent category of blood pressure. Mounting evidence suggests that blood pressure in the prehypertensive range is associated with an increased risk of developing hypertension and cardiovascular disease. Several reports have assigned a critical role for oxidative stress in these disease processes (Nambiar et al., 2009).

A positive correlation between elevated LDL and triglycerides and low HDL and oxidative stress in the animal models is well established. Other numerous metabolic and physiological changes occur in dyslipidemia patients and many of these processes stem from associated increased oxidative stress (Vasudev et al., 2006). A decrease in antioxidant enzymes in the dyslipidemia state have been reported to increase the production of reactive oxygen species. The reactive oxygen species resulting from the oxidant - anti oxidant imbalance tend to accumulate and are known to cause oxidative damage to the cellular macromolecules including the genetic material (Rao et al., 2009). Hence the present study is aimed to evaluate lifestyle induced oxidative stress by measuring the levels of lipid peroxidation as malondialdehyde (MDA).

MATERIALS AND METHODS:

46 subjects with dyslipidemia and 17 healthy subjects were selected for this study. The samples were referred from various centers of Kerala to Genetika, Centre for Advanced Genetic Studies, Thiruvananthapuram, Kerala. Detailed demographic, clinical and lifestyle characteristics were recorded using proforma. Five ml of blood was transferred into a plain tube. Blood was allowed to clot, and the serum was separated immediately. Blood sugar and lipid profile were estimated using semi-automated clinical chemistry analyzer. The level of serum biomarker for oxidative stress, malondialdehyde was determined using thiobarbituric acid as main reagent and the values are measured on a semi-autoanalyser at 540nm.

OBSERVATIONS AND RESULTS

According to MDA analysis, 46 study subjects were showed mean MDA value of 1.53 and control subjects were showed mean MDA value of 0.975. The mean MDA value of study subjects was higher than healthy control subjects.

Distribution of MDA value according to demographic characteristics

Table 1:

Category	Variables	Number (%)	MDA (U/L)
Age (Years)	<40	1 (2%)	0.809
	40-60	22 (48%)	1.219
	>60	23 (50%)	1.868
Sex	Female	23 (50%)	1.435
	Male	23 (50%)	1.624

Birth order	<5	30 (65%)	1.517
	≥5	16 (35%)	1.554
Religion	Muslim	11 (24%)	1.62
	Christian	5 (11%)	1.312
	Hindu	30 (65%)	1.533
Residence	Rural	38 (83%)	1.549
	Costal	2 (4%)	1.465
	Urban	6 (13%)	1.426
Occupation	Sedentary	25 (54%)	1.706
	Non-sedentary	21 (46%)	1.320
BMI (kg/m2)	<25	11 (24%)	1.472
	25-30	21 (46%)	1.48
	≥30	14 (30%)	1.703

Distribution of mean MDA value according to demographic characteristics of the study subjects were given in the table 1. Among the 46 study subjects, 23 subjects were above 60 years of age and showed highest mean MDA value of 1.86. The mean MDA value was comparatively higher for male subjects (1.624) than female subjects (1.435). Subjects with high birth order (≥5) had highest MDA value (1.554). Sedentary subjects were showed higher MDA value (1.706) than (1.320). Subjects with BMI ≥30 kg/m2 had higher MDA value (1.703).

Distribution of MDA value according to biochemical characteristics

Table 2:

Category	Variables	Number (%)	MDA (U/L)
Total cholesterol (TC) (mg/dl)	<200	41 (89%)	1
	200-240	2 (4%)	1.356
	>240	3 (7%)	1.568
Triglycerides (TG) (mg/dl)	<150	21 (46%)	1.449
	≥150	25 (54%)	1.626
HDL (mg/dl)	<40	42 (91%)	1.777
	40-60	4 (9%)	1.506
LDL (mg/dl)	<100	18 (39%)	1.395
	≥100	28 (61%)	1.616
hs CRP (mg/L)	<1.0	28 (61%)	1.245
	1.0-3.0	14 (30%)	1.282
	>3.0	4 (9%)	1.707
Uric acid (mg/L)	<3.49	14 (30%)	1.151
	3.49-7.19	22 (48%)	1.431
	>7.19	11 (24%)	2.253

Subjects with h/o hypertension (n=37), h/o diabetes (n=29), h/o dyslipidemia (n=42), family h/o CAD (n= 18) were showed high MDA value. Subjects with abnormal level in biochemical characters were also showed high MDA value.

Distribution of MDA value according to lifestyle characteristics

Table 3:

Category	Variables	Number (%)	MDA (U/L)
Smoking	Yes	7 (15%)	1.922
	No	39 (85%)	1.459
Drinking	Yes	7 (15%)	1.540
	No	39 (85%)	1.470
Chewing	Yes	44 (96%)	2.395
	No	2 (4%)	1.490
Diet	Vegetarian	6 (13%)	1.512
	Non- vegetarian	40 (87%)	1.641
Physical activity	Poor	18 (39%)	1.775
	Average	26 (57%)	1.596
	Good	2 (4%)	1.469
Regular exercise	Yes	13 (28%)	1.523
	No	33 (72%)	1.545

Distribution of MDA value according to lifestyle characteristics of the study subjects is given in the table. The study subjects with the habit of smoking, chewing and alcohol consumption were showed high MDA value. Majority of the subjects were non vegetarians and these showed highest MDA value. Subjects with poor physical activity and does not have a regular exercise were showed high MDA value.

DISCUSSION

According to Anjum et al., (2009) dyslipidemia shows an increasing trend with age in both males and females. Increased prevalence of higher serum lipids were more prominent in 40-50 age, which means the risk of dyslipidemia increases with increase in age. The present study indicated subjects with ≥60 years showed higher mean MDA value (1.868).

Dyslipidemia is more common in overweight and obese subjects (Anjum Humayun, et al., 2009). It is evident that there is general trend in increase in dyslipidemia with increasing BMI with age (Brown et al., 2001). In the present study, subjects with overweight and obesity showed high mean MDA value.

An improper diet and physical activity are considered to be major component of an unhealthy lifestyle that contributes significantly to the pathogenesis of cardiovascular disease (CVD) (Ramesh, et al., 2005). In the current study, those who follow unhealthy lifestyle were showed increased MDA value.

Several studies have shown that the prevalence of metabolic syndrome were significantly higher in smokers (Nakanishi et al., 2005). According to Preeti et al., (2016) cigarette smoking in young adults induces dyslipidemia in the direction of increased risk for coronary artety diseases. In the present study, 15% of the study subjects were smokers and their mean MDA value was 1.922. According to Donaldson, (2004) reported that people who drink heavily have a high mortality from all causes and cardiovascular disease, including sudden death and hemorrhagic stroke. In the present study alcoholics (7%) showed high mean MDA value of 1.922 and non alcoholics (39%) showed lower mean MDA value of 1.459.

CONCLUSION

The present study involves lifestyle induced oxidative stress in dyslipidemic patients and its risk for prehypertension. The distribution of mean MDA value according to demographic, clinical and lifestyle characteristics of the study subjects was analysed. Increase in age, BMI, and lipid profiles showed high level of mean MDA value. Poor lifestyle factors such as smoking, drinking, lack of physical exercise and improper diet were the major risk factors that can lead to Dyslipidemia and prehypertension. The existing evidence supports that oxidative stress plays a crucial role in the development of Dyslipidemia and prehypertension. These findings suggest that lifestyle modification along with physical activity, improved diet and antioxidant therapy can reduce the risk of Dyslipidemia and Prehypertension.

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