ORIGINAL ARTICLE

Morphological Changes in Aorta and Coronary Arteries of Albino Rats Fed on Palm Kernel Oil and Nigella Sativa

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ABSTRACT

Objective: To study the morphological changes in aorta and coronary arteries of albino rats fed on palm kernel oil and Nigella sativa

Materials and methods: Sixty albino rats including equal number of males and females were obtained from PCSIR Laboratories, Lahore. At the start of the experiment, they varied from 12-14 weeks of age and of 150-250 grams weight. The rats were divided into four groups labeled as C_1, E_1, C_2 and E_2. Each group had 15 rats. Two cc blood was drawn from each rat. A rat ear punch was used for this purpose. All tubes were allowed to stand for 30 minutes at 37°C and tests were measured against reagent blank at 500 nm using Labsystem Chemistry Analyser FP-901.

Results: The mean serum total lipid levels±SD showed increase in serum total lipid levels at 0 week and 24 weeks. The difference was statistically very highly significant.

Conclusion: Palm kernel oil increased the serum total cholesterol and low density lipoprotein cholesterol, decreased the high density lipoprotein cholesterol levels in all groups at 24 weeks as compared to 0 week samples. Nigella sativa decreased serum total cholesterol and low density lipoprotein cholesterol and increased high density lipoprotein cholesterol levels which were highly significant.

Keywords: Aorta, coronary arteries, albino rats, palm kernel oil, nigella sativa

INTRODUCTION

Atherosclerosis accounts for more than half of all deaths in the western world. No disease in the United States or other developed countries is responsible for more deaths. Although any artery may be affected, the major targets are the aorta, the coronary and cerebral arteries. Coronary atherosclerosis induces ischaemic heart disease (IHD) and when these lesions are complicated by thrombosis, myocardial infarction occurs, which alone is responsible for 20-25% of all deaths in United States[1]. When atherosclerosis is compounded by obesity, hypertension, smoking and diabetes, the death toll rises abruptly by arterial wall[2,3]. Out of these risk factors hyperlipidaemia is of prime significance because atherosclerosis starts from childhood[4,5]. The hyperlipidaemias may be primary or secondary and the prevalence of primary hyperlipidaemias as compared to secondary is meager one, so secondary type gets the upper hand in causing atherosclerosis[6].

Intake of palm kernel oil increases secretion of very low density lipoprotein (VLDL) particles[7]. Animals fed on palm kernel oil showed higher levels of plasma total cholesterol (TC) than animals fed on

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corn oil[8]. Human beings feel very satisfied and interiorly confident when being treated with some traditional medicine. Out of the traditional remedies, the prescriptions of Nigella sativa for the treatment of various diseases are well known since prehistoric era[9]. Amongst these various pharmacological effects of Nigella sativa, its anti-hyperlipidaemic effect was studied in the present experimental design. Palm kernel oil which contains mainly saturated fatty acids was included in the diet of experimental animals. The antiatherogenic effect of Nigella sativa associated with hyperlipidaemic state was thus studied.

MATERIALS AND METHODS

Sixty albino rats including equal number of males and females were obtained from PCSIR Laboratories, Lahore. At the start of the experiment, they varied from 12-14 weeks of age and of 150-250 grams weight. They were kept in animal's house of Postgraduate Medical Institute, Lahore. The atmospheric temperature was kept at 24±2°C on an average with food and water available all times. The rats were divided into four groups labeled as C_1 (control group fed on 3% palm kernel oil), E_1 (experimental group fed on 3% palm kernel oil with Nigella sativa), C_2 (control group fed on 20% palm kernel oil with cholic acid and thiouracil acid) and E_2

(experimental group fed on 20% palm kernel oil with cholic acid, thiouracil acid and Nigella sativa). Each group had 15 albino rats. First sample was collected as baseline before starting the experimental and control diets (0 week) and the second blood sample was collected at the end of the experiment i.e. after 24 weeks. 2cc blood was drawn from each rat. For the identification of the individual animals, the ear hole method of marking was adopted (Arrington 1978). A rat ear punch was used for this purpose. Clean and dry test tubes were labeled for each sample and standard 0.05ml (50µl) of each sample and standard were taken and put into tubes labeled "test" and "standard". 2ml (2000µl) of sulphuric acid was added to the tubes. The tubes were mixed well, plugged with cotton wool and allowed to stand in boiling water for 10 minutes then cooled in acid water for 5 minutes 0.1(100µl) of solution was taken from "test" and "standard" labeled tubes. 0.1ml (100µl) of

sulphuric acid was taken into a tube labeled as blank. 0.2ml (200µl) of colour reagent was added into all tubes. All tubes were allowed to stand for 30 minutes at 37°C and tests were measured against reagent blank at 500 nm using Labsystem Chemistry Analyser FP-901. Mean values of lipid profiles in a group at 0 and 24 weeks and between different groups at 24 weeks were compared with the help of student's 't' test.

RESULTS

The mean±SD values (mg/dl) of serum lipid profile in different groups, at 0 and 24 weeks are given Table 1. The mean serum total lipid levels±SD showed increase in serum total lipid levels at 0 week and 24 weeks. The difference was statistically very highly significant (Table 2).

Table 1: Lipid profile in different groups at 0 week and 24 weeks

Groups	0 week					24 weeks				
	TC	HDL-c	LDL-c	TG	T. lipids	TC	HDL-c	LDL-c	TG	T. lipids
C_1	80.6±5.6	22.2±4.1	43.5±8.5	73.9±7.1	400.3±6.4	94.9±4.3	20.8±6.5	50.3±6.6	118.7±6.3	447.2±8.7
E_1	80.8±4.5	20.8±3.3	44.3±4.9	75.8±6.6	395.2±6.9	95.6±3.5	26.4±4.8	45.9±4.1	121.6±4.1	447.1±8.9
C_2	81.6±4.4	21.2±3.2	45.5±5.7	74.4±7.2	398.5±4.2	198.1±7.6	27.4±1.9	140.5±8.3	150.7±4.3	545.7±5.9
E_2	80.4±5.1	22.1±3.8	42.3±6.5	74.1±6.8	398.3±5.9	195.3±6.8	38.7±4.0	126.9±4.0	148.3±4.7	546.7±7.6

Table 2: Comparison of mean serum total lipid levels (mg/dl) at 0 and 24 weeks in various groups

Groups	0 week	24 weeks
C_1	400.3±6.4	447.2±8.7[*]
E_1	395.2±6.9	447.1±8.9[*]
C_2	398.5±4.2	545.7±5.9[*]
E_2	398.3±5.9	546.6±7.6[*]

*p<0.001

DISCUSSION

In the second half of the twentieth century atherosclerotic coronary heart disease (CHD), has become an epidemic in most industrialized countries and threatens to overwhelm the developing countries as well. Atherosclerosis is the pathological process that underlies most cases of CHD, which produces extensive sickness, disability and mortality, much of it occurring in the prime of life, as well as in older persons[10]. It prevails from high to low class society and affects all ages especially the middle age group[11,12]. Increased levels of serum low density lipoprotein cholesterol (LDL-c) with positive correlation and high density lipoprotein cholesterol (HDL-c) levels with negative correlation pertaining to atherosclerosis has been found by many workers[13,14].

The gross and microscopic examination of aortae and coronary arteries revealed no change in any of rats. These results reconcile with the reports of Weisgraber et al[15] and Joris et al[16] These workers

concluded that albino rat does not develop atherosclerosis in natural state and severe hypercholesterolaemia is required to induce atherosclerosis. It is true that higher levels of TC and LDL-c were obtained which play a positive role in atherogenesis but at the same time, HDL-c level was also raised which has a protective role in the genesis of atherosclerosis. The results are in partial conformity with Newman et al[17] and Solberg & Strong.[18] There was no significant difference in mean serum levels of TC, TG and total lipids. Serum HDL-c level was increased in group E_2 as compared to C_2 which was very highly significant while serum LDL-c level was decreased which also was very highly significant. These results are in complete conformity with Dahri.[19] On gross and microscopic examination of aortae and coronary arteries no lesion was seen. This may be due to decreased LDL-c and increased HDL-c levels as also reported by other workers.[20,21] The atheroma formation was prevented by decreasing atherogenic LDL-c level and raising HDL-c level. The possible mechanism of LDL-c decrease may be the enhacement of LDL-receptors on hepatocytes. The LDL-c may have been taken up by the hepatocytes. As already reported by Ali and Blunden[22], the hepatocytes might utilize cholesterol to form bile acids and then secreted into the bile. The possible mechanisms of HDL-c raising effect of Nigella sativa are not known.

CONCLUSION

Palm kernel oil (containing 75% saturated fatty acid) raises serum levels of total cholesterol and low density lipoprotein cholesterol. It also decreases the serum high density lipoprotein cholesterol level. So it has a strong atherogenic potential. Nigella sativa increases the serum levels of total cholesterol and low density lipoprotein cholesterol and it prevents the process of atherogenesis. Although modest hypercholesterolaemic state can be achieved with high fat (20% palm kernel oil) diet along with cholic acid and thiouracil but this is not of that intensity to produce the atherosclerotic lesions.

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