Effect of Olive Oil and Corn Oil (% Induced Hyperlipidemia State) in Aorta and Coronary Arteries of Albino Rats

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Background: The role of different oils play an important role for the development of atherosclerosis, and hyperlipidemia which is defined as an elevation of plasma lipids which include high level of plasma LDL. The low serum HDL is a powerful risk factor in CHD. The relation ship between the LDL and HDL in the development of CVD is of interest. The level of cholesterol fraction and the changes in aorta and coronary arteries are compared with control and experimental groups in this study.

Methods: 48 albino rats of 32 week age, including equal number of male & female were kept at optimum atmospheric and hygienic conditions with food and water available at all times. A ventral mid line abdomino-thoracic incision was made after replacing the albino rats in the ether till death. Heart and aorta was then dissected out and biopsy specimen were kept in labeled jar for fixation, containing formaline and formal calcium.

Results: A total 48, 32 weeks albino rats were studied for atheromatus changes in aorta and coronaries. The changes of control and experimental groups were compared.

Conclusion: The current study shows that the groups which was given olive oil showed less atheromatus lesions as compare to the groups with corn oil. Thus olive oil has more beneficial potential then corn oil, and at least, it can be recommended for the high risk patients of ischemic heart disease.

Introduction

Coronary heart disease (CHD) is particularly common in affluent countries and one obvious difference between these countries and poorer nation is the diet. The high prevalence of CHD in eastern finland, where intake of butter products are particularly high, is its striking example.[1] Where as populations that habitually consume low fat diet like Japan, China, Southern Italy Greece, Green land and Eskimos have low prevalence of CHD.[2]

In a study of 130 human autopsies carried out in the mortuary of the King Edward Medical College Lahore, Atherosclerosis was present in 91.5% of the cases and all of them were found to be due to intake of saturated fat diet i.e, butter and ghee.[3] The first morphological change in the initiation of atherosclerosis is the migration of monocytes through an intact endothelial surface into the intima, these monocytes subsequently take up LDL-c and become lipid filled macrophages called foam cells,[4] where as camejo et al.[5] Refers the progressing atherosclerotic lesion as to a continuous extra cellular and intracellular accumulation of lipoproteins. The LDL-c particles when presents in access in the blood are deposited in the tissues and in the artery wall to firm atherosclerotic plaque.[6] This atherosclerotic plaque then grows by the production of collagen fibers and smooth muscle cells.[7]

The dietary oils, the chief fatty acids, mono unsaturated i.e. olive oil, polyunsaturated i.e corn oil are the types of fatty acids. Fatty acid composition of the various experimental oils / fats is shown in table 1.

Table 1: *Fatty Acid Composition of various Edible. Fats in Percent of Total Fatty Acids.*

Name of Oil	Per 100g of Total Oil											
	Saturated						Unsaturated					
	C10 and Lower	C12	C14	C16	C18	C20 and Higher	C14	C16	C18	C18	C18	C20 and Higher
Olive Oil	–	–	–	13.5	2.5	0.5	–	1.5	73.5	8.0	T	0.5
Corn Oil	–	T	T	13.0	2.5	0.5	–	T	32.5	50.0	1.0	0.5

T=Trace — = Single Bond — = Double Bond — = Triple Bond

Olive oil is a source of calories as monounsaturated fatty acids of which oleic acid is the major component with palmatic and lenoleic acids in smaller proportions[8]. Conner et al[9]. Recommended that the dietary intact of poly unsaturated fat should not be increased in human beings due to its high caloric content and the association of polyunsaturated fat with the development of gall stones, Breast cancer and cancers of the colon.

Table 2.1: *Percentage Composition of Synthetic Diet for Rats. (Malathi et al 1963).*

Ingredients	Percentage(g)
Casein	20.0
Maize Starch	60.0
Cane Sugar	10.0
Corn oil	5.0
Choline and Methionine	0.5
Mineral Mixture	3.5
Vitamin Mixture	1.0
Total:	100.00

An experimental study was carried out for 12 weeks at the post graduate medical institute Lahore, to compare the relative effects of mono-unsaturated (olive oil), poly-unsaturated (corn oil), on the serum lipids and lipoprotein cholesterol levels.[10] The results of the study were encouraging and permit to work further on the same animals by adding atherogenic supplement diet and study the effect of olive oil and corn oil induced hyperlipidemia in aorta and coronary arteries of albino rats.

Materials and Methods

48 albino rats of 32 weeks age, including equal number of males and females were distributed randomly into four groups of 12 rats each. Each group had equal number of male and female rats. The albino rats were maintained under optimum atmospheric and hygienic conditions, with food and water available at all times. The initial experimental diet (Table 2.1) was given for 12 weeks, and then atherogenic supplement, namely cholesterol, propyl thio uracil and bile salt was added to the experimental diet for 12 weeks, as shown in table 2.2. At the end of the experiment i.e 32 weeks heart and aorta was then dissected out biopsy specimen were kept out in labeled jar for fixation, containing formal Saline and formal calcium.

Results

Gross and microscopic changes were observed in the thoracic aorta of the animals after 32 weeks of experimental diet (Table 3.1 and 3.2). In control group I without atherogenic diet, on gross examination, no fatty streak nor atheromatus plaque was seen on microscopic examination no atherosclerotic lesion was seen. Control group II with atherogenic diet revealed on gross examination, fatty streaks seen in eight out of twelve animals including five (41.66%) male and three (25%) females. (Table 3.3). On microscopic examination H+E stain revealed four cases 1(8.33%) male and 3 (25%) female, of stary I lesion and stary II lesion van-Gieson stain showed mild internal wall thickness in all the twelve cases. Oil red 0 stain showed presence of fat in eight out of twelve cases (Table 3.4). The results were statistically very highly significant as compared to control group-I.

Olive oil group on gross examination showed to fatty streak nor atheromatus-plaque in any of the twelve cases. On microscopic examination H+E stain revealed stary-I lesion in all the twelve Cases. Van Gieson stain revealed mild proliferation of collagen fibers, verhoeff's elastic stain, showed mild intimal wall thickness and total wall thickness in all the twelve cases. Oil Red 0 stain showed absence of fat in all the twelve cases (Table 3.5). The results were statistically non significant, as compared to control group-II.

Corn oil group on gross examination showed no fatty streak, nor atheromatus plaque in any of

Table 2.2: *Percentage Composition of the Experimental Diets(g).*

Diet Groups					
		I	II	III	IV
S. No.	Ngredients	Control	Control	Olive	Corn
		Diet (%)	Diet (%)	Oil (%)	Oil (%)
1.	Wheat starch	60.0	58.6	43.6	43.6
2.	Casein	20.0	20.0	20.0	20.0
3.	Cane Sugar	10.0	10.0	10.0	10.0
4.	Olive oil	1.0	1.0	20.0	-
5.	Corn oil	1.0	1.0	-	20.0
6.	Choline & Methionine	0.5	0.5	0.5	0.5
7.	Mineral Mixture	3.5	3.5	3.5	3.5
8.	Vitamin Mixture	1.0	1.0	1.0	1.0
9.	Cholesterol	-	1.0	1.0	1.0
10.	Propylthiouracil	-	0.1	0.1	0.1
11.	Bile Salt	-	0.3	0.3	0.3

Table 3.1: *Morphological changes in thoracic aorta of 48 cases in relation to different groups and sex (Gross Findings).*

Group	Fatty Streak		Atheromatous plaque	
	M	F	M	F
I	-	-	-	-
II	5	3	-	-
III	-	-	-	-
IV	-	-	-	-

Key:

Group I = Control without atherogenic diet.
Group II = Control with atherogenic diet.
Group III = Olive Oil diet.
Group IV = Corn Oil diet.

the twelve cases. On microscopic examination H+E stain revealed stary-I lesion an all the twelve cases Van-Gieson stain revealed moderate proliferations of collagen fibres, verhoeff's elastic stain showed moderate intimal wall thickness and total wall thickness in all the twelve case, oil red 0 stain showed abs-ence of fat deposition in all the twelve cases (Table 3.6). The results were statistically highly significant as compared to control group-II.

Discussion

This study was conducted to examine the morphological changes of aorta and the coronaries in consequence to olive oil with corn oil. In this study on gross examinations in aorta, the fatty streaks were present in (eight) 08 out of forty eight (48) animals. Microscopic examinations of the aorta and coronaries showed stary I lesion in 28 out of 48 animals, stary-II lesion in 8 out of 48 animals, and moderate intimal wall thickness, and presence of fat , 12 out of 48 animals, and these results suggest that olive oil which show no presence of fat in the intimal walls of aorta and coronaries, has a protective role in atherosclerosis. As coronary heart disease is the result of atherosclerosis, in which deposits of cholesterol and other lipids i.e. fats, thicken the artery walls. This process gradually reduces the calibre of the artery and restricts blood flow, leading to myocardial infarction or sudden death. This conclusion is based on experimental laboratory work, extensive clinical and pathological research and numerous epidemiological studies over the past several decades[11]. In Greece, 40% of diet energy on average comes from fat. However, the diet is high in olive oil, in which major fat is the monounsaturated in oleic acid, with the low incidence of CHD[12]. The

Table 3.2: *Morphological Changes in Thoracic Aorta of 48 Cases in Relation to Different Groups-and Sex (microscopic Finding).*

Group	Sex	H& E Stain				Oil Red O Stain		Van Gieson Stain			Verhoeff's Elastic Stain					
		Number of Cases with Stary Lesion				Fat		Proliferation of Collagen Fibres			Thickness of intima			Total wall Thickness		
		I	II	III	IV	Number of Case Present	Number of Cases Absent	Mild	Moderate	Severe	Mild	Moderate	Severe	Mild	Moderate	Severe
I	M	-	-	-	-	-		-	-	-	-	-	-	-	-	-
	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
II	M	1	5	-	-	5	1	6	-	-	6	-	-	6	-	-
	F	3	3	-	-	3	3	6	-	-	6	-	-	6	-	-
III	M	6	-	-	-		6	6	-	-	6	-	-	6	-	-
	F	6	-	-	-		6	6	-	-	6	-	-	6	-	-
IV	M	6	-	-	-	-	-	-	6	-	-	6	-	-	6	-
	F	6	-	-	-	-	6	-	6	-	-	6	-	-	6	-

Table 3.3: *Number and Percentage Distribution in Morphological Changes of Aorta and Choronaries in Relation to Group II with Atherogenic Diet (Gross Findings) Figure in Parenthesis Indicate Percentage.*

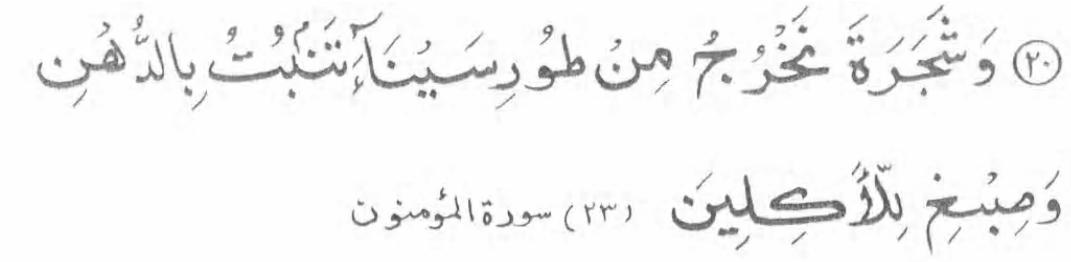
Blood vessels	Sex	Fatty Streak		Atheromatous plaque	
		No	%	No	%
Thoracic	M	5	(41.66)	-	
Aorta	F	3	(25)	-	
Abdominal	M	5	(41.66)	-	
Aorta	F	3	(25)	-	
Coronaries	M	-		-	
	F	-		-	

Table 3.4: *Number and Percentage Distribution of Morphological Changes in Aorta and Coronariies in Relation to Control Group-II with Athrogenic Diet (Microscopic Finding) Figures in Parenthesis Indicate Percentage.*

	Sex	H& E Stain				Oil Red O Stain		Van Gieson Stain			Verhoeff's Elastic Stain					
		Number of Cases with Stary Lesion				Fat		Proliferation of Collagen Fibres			Thickness of intima			Total wall Thickness		
		I	II	III	IV	Number of Case Present	Number of Cases Absent	Mild	Moderate	Severe	Mild	Moderate	Severe	Mild	Moderate	Severe
Tho-racic	M	1	5	-	-	-		6	-	-	6	-	-	6	-	-
		(8.33)	(41.66)			(41.66)	(8.33)	(50)	-	-	(50)			(50)		
Aorta	F	3	3	-	-	3	3	6	-	-	6	-	-	6	-	-
		(25)	(25)			(25)	(25)	(5)	-	-	(50)			(50)		
Abdo-minal	M	1	5	-	-	5	1	6	-	-	6	-	-	6	-	-
		(8.33)	(41.66)			(41.66)	(8.33)	(50)	-	-	(50)			(50)		
Aorta	F	3	3	-	-	3	3	6	-	-	6	-	-	6	-	-
		(25)	(25)			(25)	(25)	(50)	-	-	(50)			(50)		
Coro-naries	M	6	-	-	-		6	6	-	-	6	-	-	6	-	-
		(50)					(50)	(50)	-	-	(50)			(50)		
	F	6	-	-	-		6	6	-	-	6	-	-	6	-	-
		(50)					(50)	(50)	-	-	(50)			(50)		

work of Keys et al 13 and Grundy[14]. Suggest that there may be an inverse association between dietary oleic acid and Ischemic heart disease.

Olive oil is highly appreciated by almighty Allah, as mentioned in the Holy Quran.



Also a tree springing , Out of Mount Sinai, Which produces oil, And relish for those Who use it for food

(Al-Muminun 23)

The wide spread use of various oils and fats, and their relation to the higher incidence of CHD is of interest in the modern trend of life. The teachings of the creator Allah and his messengers Holy prophet Muhammad (Peace be upon him) who took end less pains to guide humanity to the destinations of ultimate success and who enabled us to recognize our creator, need not any scientific proof but there teachings provide an incentive to explore the un-explained and un earth potentials. The scientific explanations would further strengthen the faith of the believers.

Conclusion

On the basis of these findings it is calculated that mono-unsaturated, olive oil is found to be least atherogenic, so it can be recommended at least for the high risk IHD individuals.

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