Effect of Moderate Intake of Ethanol on Lipid Profile of Wistar-Albino Rats Fed High Fat Diet

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Abstract—Many evidences suggest that light to moderate alcohol drinking may provide some cardiovascular benefits. The present study examined the impact of how moderate ethanol consumption provides protective effect against high blood cholesterol. Wistar-Albino rats were divided into control group (I) and test groups (II, III, IV). The test groups (II, III, IV) were administered with a predefined dosage of 10%, 20% and 30% ethanol respectively following twenty days of high fat routine however, control animals were managed with normal saline for the next fifteen days. Significant difference in lipid profile parameters witnessed before and after ethanol administration between the control and test groups. Findings from the study suggests that 10% moderate ethanol is adequately least enough to reduce the risk of cardiovascular diseases by improving the blood cholesterol in Wistar-Albino rats.

Keywords—Cardiovascular Diseases, Lipid Profile, Moderate Ethanol and Hyperlipidemia.

I. INTRODUCTION

Alcohol consumption can be the cause of several diseases, and it is well known, the high burden of its consumption over mortality around the world.[1] Long haul liquor use expands the danger of liver malady, coronary illness, peptic ulcers, specific sorts of malignant growths, birth imperfections, and central nervous system harm.[2,3] Albeit over the high liquor utilization is certainly unsafe, steady epidemiological proof has called attentions that moderate liquor utilization is contrarily connected with cardiovascular hazard factors and cardiovascular occasions.[4,5] The mechanism of this potential cardioprotective impact of liquor is ripe ground for explore. Also, the advantages of ethanol over different types of liquor has not been demonstrated clinically, particularly regarding consequences for the lipid profile. At long last, direct proof to suggest savoring liquor control for diminishing cardiovascular hazard is as yet missing and exhibits another road for clinical research. In perspective on all the above mentioned, the study was done utilizing high-fat eating regimen to initiate hyperlipidemia in Wistar-Albino rats and expects to research the impact of various degrees of moderate ethanol on lipid profile.

II. METHODOLOGY

Healthy male Wistar-Albino rats weighing around 150 to 170 grams were utilized for this examination. They were gotten from Animal House Facility, Dr. ALM PGIBMS, University of Madras, Chennai. The rats were assembled and housed in polypropylene confines and kept up under standard research facility conditions (temperature $25 \pm 2^\circ\text{C}$) with dim/light cycle (14/10 hours). They were enabled free access to standard dry pellet diet (provided by animal house office) and refined water.

The experimental animals were partitioned into four gatherings (GROUP I, II, III, IV), each group involving six animals. At first, all the animals were encouraged with standard dry pellet and refined water and the controls (GROUP I) tested for the lipid profile. Then, the standard dry pellet diet is supplanted by high-fat regimen which is followed for twenty days. Following twenty days, the control animals were tested for lipid profile again. At that point, the test groups (II, III, IV) were administered with a predefined convergence of 10%, 20% and 30% ethanol respectively though, control animals were managed with normal saline for the next fifteen days. The ethanol was administered intraperitoneally. At long last, all the three test groups were tested for lipid profile.

Fig. 1. Illustration of Experimental Design

The composition of the Normal Control Diet (NCD) and High Fat Diet (HFD) is formulated in the study was based on AIN-93G rodent diet composition as recommended by the American Institute of Nutrition [6], with minor modifications in the fat components, namely, soya oil and lard. Ethanol focuses viz., 10%, 20% and 30% with normal saline were utilized to determine the impact. A minimal dosage of 0.015ml/gm body weight every day was fixed as the ideal dose for the investigation.

Phlebotomy is done from medial canthus using the capillary tubes and the blood sample is collected in EDTA

tube. [7] And the laboratory investigation for the analysis of lipid profiling was performed.

The values were expressed as mean $\pm$ SD for six rats in each group. All data were analyzed with GraphPad Prism V7.0 software. Hypothesis testing method included one-way analysis of variance (ANOVA) with post hoc analysis using Tukey's multiple comparison test was used for the rest data. Values of ($p < 0.05$) were considered as significant.

III. RESULTS

The results are recorded statistically, values of animal fed normal control diet is taken as negative control and the values after animal fed high-fat diet were taken as positive control.

A. Total Cholesterol

TABLE I: Values of Total Cholesterol (mg/dL) in control and ethanol treated rats.

Groups	Total Cholesterol
Negative Control	92.5 $\pm$ 6.2
Positive Control	165 $\pm$ 8.24
10% Ethanol	59.38 $\pm$ 2.2
20% Ethanol	60 $\pm$ 6.62
30% Ethanol	56.87 $\pm$ 3.56

Values represents, Mean $\pm$ SD, (n=6)

Fig. 2. Mean $\pm$ Standard deviation of Total Cholesterol concentration (mg/dL) in control and ethanol treated rats.

Table 1 and Figure 2 represents the results of Total Cholesterol of control and ethanol treated animals. Total Cholesterol level is significantly increased ($P < 0.0001$) in positive control rats when compared with that of negative control rats. A significant decrease ($P < 0.0001$) was observed in 10% ethanol treated, 20% ethanol treated and 30% ethanol treated rats when compared with that of Positive Control rats. But there is no significant increase or decrease between the different ethanol treated groups.

B. Triglyceride

TABLE 2: Values of Triglyceride (mg/dL) in control and ethanol treated rats.

Groups	Triglyceride
Negative Control	77.42 $\pm$ 4.54
Positive Control	159.84 $\pm$ 6.65
10% Ethanol	45.81 $\pm$ 1.77

20% Ethanol 52.26 $\pm$ 9.95
30% Ethanol 32.26 $\pm$ 7
Values represents, Mean $\pm$ SD, (n=6)

Fig. 3. Mean $\pm$ Standard deviation of Triglyceride concentration (mg/dL) in control and ethanol treated rats.

Table 2 and Figure 3 represents the results of Triglyceride of control and ethanol treated animals. Triglyceride level is significantly increased ($P < 0.0001$) in positive control rats when compared with that of negative control rats. A significant decrease ($P < 0.0001$) was observed in 10% ethanol treated, 20% ethanol treated and 30% ethanol treated rats when compared with that of positive control rats. Among the ethanol treated groups, a significant decrease was observed in 30% ethanol treated rats ($P = 0.0002$) to that of 20% ethanol treated rats and ($P = 0.0117$) to that of 10% ethanol treated rats.

C. High-Density Lipoprotein

TABLE 3: High-Density Lipoprotein (mg/dL) in control and ethanol treated rats.

Groups	High-Density Lipoprotein
Negative Control	28.3 $\pm$ 7.14
Positive Control	37.3 $\pm$ 4.36
10% Ethanol	22.89 $\pm$ 1.05
20% Ethanol	15.69 $\pm$ 4.63
30% Ethanol	11.2 $\pm$ 2.45

Values represents, Mean $\pm$ SD, (n=6)

Fig. 4. Mean $\pm$ Standard deviation of High-Density Lipoprotein concentration (mg/dL) in control and ethanol treated rats.

Table 3 and Figure 4 represents the results of High-Density Lipoprotein of control and ethanol treated animals. High-Density Lipoprotein level is significantly increased ($P = 0.0135$) in positive control rats when compared with that of negative control rats. A significant decrease ($P < 0.0001$) was observed in 10% ethanol treated, 20% ethanol treated and 30% ethanol treated rats when compared with that of positive control rats. Among the ethanol treated rats, a significant increase ($P = 0.0010$) was observed in 10% ethanol treated rats to that of 30% ethanol treated rats. But there is no significant difference between 10% & 20% nor 20% & 30% ethanol treated rats.

D. Very-Low Density lipoprotein

TABLE 4: Values of Very-Low Density Lipoprotein (mg/dL) in control and ethanol treated rats.

Groups	Very-Low Density Lipoprotein
Negative Control	15.48 ± 0.91
Positive Control	31.97 ± 1.33
10% Ethanol	9.16 ± 0.35
20% Ethanol	10.45 ± 1.99
30% Ethanol	6.45 ± 1.4

Values represents, Mean $\pm$ SD, (n=6)

Fig. 5. Mean $\pm$ Standard deviation of Very-Low Density Lipoprotein concentration (mg/dL) in control and ethanol treated rats.

Table 4 and Figure 5 represents the results of Very-Low Density Lipoprotein of control and ethanol treated animals. VLDL level is significantly increased ($P < 0.0001$) in positive control rats when compared with that of negative control rats. A significant decrease ($P < 0.0001$) was observed in 10% ethanol treated, 20% ethanol treated and 30% ethanol treated rats when compared with that of positive control rats. Among the ethanol treated groups, a significant decrease was observed in 30% ethanol treated rats ($P = 0.0002$) to that of 20% ethanol treated rats and ($P = 0.0117$) to that of 10% ethanol treated rats.

E. Low-Density Lipoprotein

TABLE 5: Values of Low-Density Lipoprotein (mg/dL) in control and ethanol treated rats.

Groups	Low-Density Lipoprotein
Negative Control	48.72 ± 6.54

Positive Control	95.73 ± 7.21
10% Ethanol	27.32 ± 2.62
20% Ethanol	33.86 ± 3.8
30% Ethanol	39.22 ± 5.78

Values represents, Mean $\pm$ SD, (n=6)

Fig. 6. Mean $\pm$ Standard deviation of Low-Density Lipoprotein concentration (mg/dL) in control and ethanol treated rats.

Table 5 and Figure 6 represents the results of Low-Density Lipoprotein of control and ethanol treated animals. LDL level is significantly increased ($P < 0.0001$) in positive control rats when compared with that of negative control rats. A significant decrease ($P < 0.0001$) was observed in 10% ethanol treated, 20% ethanol treated and 30% ethanol treated rats when compared with that of positive control rats. Among the ethanol treated groups, a significant decrease ($P = 0.0073$) was observed in 10% ethanol treated rats to that of 30% ethanol treated rats. But there is no significant difference between 10% & 20% nor 20% & 30% ethanol treated rats.

IV. DISCUSSION

The concentration of lipid profile parameters subsequent to nourishing the animals with high fat eating routine has significant increment ($P < 0.0001$) in all animals for total cholesterol, triglyceride, very low-density lipoprotein, low density lipoproteins and noteworthy increment ($P = 0.0135$) in every one of the animals for high-density lipoprotein. These aftereffects elevation in concentration, is close with the other studies that indicated the diet and lipoprotein subclass profile have cross-sectional relationship with single supplements and proposed that soybean oil and lard might be significant in deciding serum lipoprotein molecule subclass appropriation. [8,9]

Also, significant decrease ($P < 0.0001$) in blood cholesterol is seen in the present study after the ethanol administration. This might be mechanistically connected with a study in which moderate levels of ethanol consumption prompted the downregulation of genes involved in cholesterol synthesis. [10] Inevitably, the present study reveals that light-to-moderate ethanol consumption is linked with improved cardiovascular outcomes. Subsequently, there is no significant difference found between the ethanol treated groups in case of total cholesterol levels. Concurrently, other parameters in particular of High-Density Lipoprotein levels, significant increase ($P = 0.0010$) was observed in 10% ethanol treated rats to that of 30% ethanol. It indicates strong dose-response association between intake of ethanol and

concentrations of high-density lipoprotein. These observations rely with many other researches that emphasize the moderate alcohol intake is correlated with the prevention of coronary heart disease mediated by a rise in the concentration of high-density lipoprotein. [11–13]

V. CONCLUSION

It was observed from the research that intake of moderate amount of ethanol caused some metabolic changes and has improved blood cholesterol levels by elevating high density lipoproteins. Also, the experimental data reveals that the least moderate ethanol has shown significant effects with fifteen days administration, the biochemical parameters broke down in this study was able to statistically change. In general, improved cardiovascular outcomes were seen in the lipid profiles of the Wistar-Albino rats by utilizing 10% moderate ethanol which is least enough.

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ETHICAL APPROVAL

Ethical approval taken from Institutional Ethics committee.

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