Lipid parameters in non-moderate and prolonged drinking of alcohol

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Abstract

Alcohol consumption in moderate amount is cardio-protective and its beneficial effect is largely mediated through its impact on cholesterol; however the impact of non-moderate drinking on lipid parameters has not been evaluated. This study was designed to assess the effect of non-moderate and prolonged drinking on various lipid values. Fifty non-moderate drinkers (>25 g/day for last 10 years) were selected and lipid profile measurement was done at fasting state and findings were analyzed and the level was correlated with life time intake amount. Mean daily intake, duration and life time intake amount of alcohol were 64.3 g, 22 years and 502 kg respectively. Only 4 % and 16% alcohol users had high and borderline high total cholesterol respectively. Majority (72 %) has optimal level of HDL and only 22 % and 6 % had low and high level respectively. Similarly, majority alcohol users (80 %) had desired level of total cholesterol. Only 38 % alcoholic subjects had normal, others, 20 % and 40 % had either borderline high or high triglyceride level respectively. Regarding the LDL, majority has optimal (60 %) or near optimal (38 %), only 2 % had borderline high level. Similarly, regarding non-HDL, only 12 % subjects had high and majority (88 %) had optimal level. In correlation analysis, the relation between lifetime intake amount and these lipoprotein levels was inconclusive. In conclusion, the prolonged and non-moderate drinking was associated with mostly optimal and desired level of various lipid parameters. The only undesirable effect of alcohol consumption was the high triglyceride level that was recorded in majority. However, the correlation of the levels of these lipoproteins with life time intake was inconclusive.

Key words: Alcohol, lipid profile, cardio protective.

Introduction

The putative cardio protective effect of ethanol has been widely discussed. In general, the detrimental effects of alcohol on cardiac function are linked to non-moderate drinking and the cardio protective effects to moderate.[1] The effect of alcohol consumption on cardiovascular health depends on the amount of alcohol consumed and the duration of intake. Moderate alcohol intake defined as one drink or less per day for women and two drinks per day for men,[2] has been shown to reduce coronary heart disease (CHD) in large number of observational studies.[3-5] Consumption of one or two drinks per day is associated with a reduction in risk of dying from CHD by approximately 30-50%.[6-8] In addition, it has been clearly demonstrated that

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there is a J or U shaped relation between alcohol consumption and total mortality.[3,7,8] Alcohol intake in moderate amount is associated with reduction in cardiovascular events and the lowest mortality occurs in those who consume 12 – 24 g of ethanol per day.[2]

Alcohol has numerous effects on various risk factors for cardiovascular disease including lipoprotein metabolism. Alcohol consumption has been found to be associated with increased serum levels of very low density lipoproteins (VLDL) and high density lipoproteins (HDL).[9,10] The increase in HDL cholesterol has been estimated to account for half of the beneficial effects of alcohol consumption on cardiovascular events.[11]

Alcohol has narrow therapeutic range and only the moderate drinking has beneficial effects on cardiovascular health.[6] Non-moderate drinking is associated with congestive heart failure, hypertension, arrhythmias and sudden cardiac death,[12-15] and it is the major identifiable cause of secondary dilated cardiomyopathy (DCM) which is responsible for one third of all cases of DCM.[3,16, 17]

Prolonged excessive drinking causes various structural and functional abnormalities of heart which can be detected on echocardiography. The reversibility of these changes has also been observed in those who have abstained.[6] However, the long-term alcoholism is associated with symptomatic left ventricular dysfunction in one third of cases,[18,19] whereas two thirds of them without symptoms demonstrate significant cardiac abnormalities on echocardiography.[19,20] In addition, the symptoms of heart failure in these patients do not differ to that from other causes. However few studies had reported poorer prognosis in subjects with alcoholic cardiomyopathy when compared with patients with idiopathic DCM.[21]

The effect of moderate drinking on lipid metabolism leading to cardio protective mechanism has been well demonstrated.[9-11] However, the effects of non-moderate drinking on lipid is largely speculative. Therefore, this study was designed to assess the lipid profile abnormalities in subjects with non-moderate drinking and correlate the lifetime intake amount with the severity of lipid abnormalities.

Material and methods

This study was conducted in BP Koirala Institute of Health Sciences, Dharan, a tertiary referral center of eastern Nepal and was approved by the ethical committee. It included non-moderate drinkers; i.e. at risk drinking (National Institute on Alcoholism and Alcohol Abuses) [22,23] taking >2 standard drinks or ≥ 25 g/day of ethanol equivalent to 250 ml of homemade liquor or 230 ml of non- fortified wine, 86 ml of whisky or vodka, of 30 - 55 years age for at least 10 years or more. Subjects suffering from any acute illness, and other chronic disorders known to have dyslipidemia such as diabetes, thyroid disorders, familial hypercholesterolemia, advanced end stage hepatic or renal diseases were excluded.

A detailed history of drinking including types, frequency and average amount were recorded. The current daily intake was considered to be the average of alcohol consumed per day during the last month. Life events such as marriage, military service, festivals and work posts were used as

'anchor points' to assist in recollection (time-line follow-back method).[24] Daily intake amounts were expressed in gram of ethanol and lifetime intake amount till the day of assessment was calculated. The strength of different alcoholic beverages was taken as: [25] beers - 3.4 - 9% v/v, white wine - 8 - 13% v/v, vodka - 37.5 - 57.5% v/v, whisky - 32 - 40% v/v, rum - 32 - 40% v/v. Comprehensive clinical assessment was carried out using structured protocol after an informed consent. Each subject underwent fasting lipid profile assessment.

Lipid profile assessment

The lipid profile is a group of tests that are often ordered together to determine risk of cardiovascular diseases (CVD). The presence of any abnormalities in these tests is called dyslipidemia and it is one of the major risk factors for cardiovascular diseases.

A venous blood sample was drawn in the morning after 8 to 14 hours of fasting by inserting a needle into a vein in the arm and sent for analysis in central laboratory. Lipid profile measured included total cholesterol (TC), HDL, low density lipoprotein cholesterol (LDL) and the triglycerides (TG). An extended lipid profile values such as VLDL and non-HDL cholesterol were calculated by using the formulas, $VLDL = TG/5$ and non-HDL $= TC - HDL$ respectively.

Classification of Total, LDL, and HDL Cholesterol

Various lipid parameters were classified as per the guidelines given in the executive summary of the third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III).[26]

LDL Cholesterol:

- Optimal   <100
- Near optimal/above optimal   100-129
- Borderline high   130-159
- High   160-189
- Very high   >190

Total Cholesterol

- Desirable   <200
- Borderline high   200-239
- High   >240

HDL Cholesterol

- Low   <40
- Optimal   40-60
- High   >60

For extended lipid profile parameters, triglycerides and non-HDL the following classification was used as adopted in ATP III.

Serum triglycerides:

- Normal triglycerides: <150 mg/dL
- Borderline-high triglycerides: 150-199 mg/dL
- High triglycerides: 200-499 mg/dL
- Very high triglycerides: >500 mg/dL

Non HDL cholesterol:

- Optimal: < 150 mg/dl
- High   > 150

Statistical analysis

SPSS 16.0 version was used for data processing and analysis. The mean and standard deviation of different variables were calculated. These parameters of lipid profile were compared with standard reference values classified as per ATP III.[26] The correlations of lifetime intake amount and

various lipid profile parameters were assessed by calculating Pearson's coefficient.

The significance of any differences in means between the groups with different amount was tested using 'F test' and the significance of the differences between male and female, smokers and non-smokers were tested using 'student t test'. The significance of correlation analysis was determined by locating corresponding p value from table. The confidence intervals were calculated at the 95 % level. P values < 0.05 were considered statistically significant at 5 % level and < 0.01 at 1 % level.

Results

The baseline characteristics of the subjects included in this study was as below (Table I).

Table I. Baseline characteristics

Characteristic	Alcoholic subject(SD)
M:F	2.1:1
Mean age (years)	45.1 (7.72)
Mean BMI (kg/m^2)	21.7(3.88)
Mean BSA (m^2)	1.56 (0.17)
Mean systolic BP (mmHg)	117.5 (33.8)
Mean diastolic BP (mmHg)	76.5 (20.6)
Mean WHR	0.95 (0.08)
Mean body weight (kg)	55.6 (10.7)
Mean waist circumference (cm)	81.4 (9)
Smoking (%)	66
Obesity (%)	4
Overweight (%)	10
Central obesity (%)	24

In this subjects, mean alcohol consumption was 76 g/day with a range of 25 to 150 g and the mean duration was 20.2 years ranging from 10 to 40 years. Mean lifetime alcohol amount was 489.86 kg with

a range of 91.2 to 1277.5 kg. The lifetime intake of alcohol was less than 250 kg in 14%, 250-500 kg in 44% and more than 500 kg in 42% of the alcohol users. Sixty-six percent subjects were smokers. The proportion of subjects with central obesity, overweight and obesity was 24, 10 and 4 percent respectively. Majority of the subjects were male with male to female ratio 2.1:1.

The values of total, HDL, LDL, and VLDL non HDL cholesterol were 175.7, 48.4, 98.5, and 39.5 mg/dl respectively. Extended lipid profile parameters such as non HDL cholesterol and triglycerides level were 121.9 and 211 mg/dl respectively (Table II).

Table II. Mean lipid profile parameters of alcoholic subjects.

Parameters	Alcohol users (SD)
Total cholesterol *(mg/dl)*	167 (38.06)
HDL cholesterol *(mg/dl)*	45.14 (6.99)
LDL cholesterol *(mg/dl)*	94.42 (18.86)
Triglycerides *(mg/dl)*	187.5 (81.87)
VLDL cholesterol *(mg/dl)*	37.5 (16.36)
Non-HDL cholesterol *(mg/dl)*	121.9 (36.67)

In this study, most of the alcoholic subjects had favorable lipid parameters. Majority of these subjects had desired level of total cholesterol (80 %). Sixteen percent had borderline high TC level and only 4% had high level of total cholesterol. Regarding LDL level, 60 % had optimal level of LDL. Remaining 38 % and 2 % had near optimal and borderline high level of LDL cholesterol respectively. No one had high or very high level of LDL cholesterol. Only 22 % had low and 6 % had

high level of HDL and majority (72 %) had normal level of HDL cholesterol. In addition, 40 % of these subjects had high level of TG and remaining 38 % and 22 % had normal and borderline high level of TG respectively. Regarding the non-HDL cholesterol, only 12 % had high and remaining 88 % had optimal level.

In a sub analysis by dividing these subjects in three groups depending on the lifetime intake amount of ethanol (group A – subjects with life time intake amount of alcohol less than 250 kg, group B – 250 – 500 kg and group C > 500 kg, table III and IV), there was a decreasing trend in total cholesterol level from 175.7 mg/dl in group A to 173.8 mg/dl

in group B and 157.1 in group C. Similar decreasing trend was also noticed in LDL and non HDL cholesterol level. However, there was an increasing trend in triglyceride level in these groups from 182.7 mg/dl in group A to 204 .8 mg/dl in group C. Regarding HDL cholesterol level, there was an initial rise in group B, but in group C, there was a fall; however, these values were not significant statistically. Similarly there was no relation between higher lifetime intake amount and BMI or body weight. Although, there was some increase in the proportion of central obesity based on value of waist circumference, possibly it was due to the presence of ascites in few subjects.

Table III. Characteristics of alcoholic subjects in various groups according to life time intake amount (A – < 250 kg, B – 250 –500 Kg and C - > 500 Kg).

Characteristic	Group A (n = 7)	Group B (n = 20)	Group C (n = 23)
M:F 4:3	1.2:1	7.6:1	
Mean age (yrs)	38.43(7.2)	44.62 (8.33)	47.43 (5.88)
Mean BMI (kg/m^2)	23.23(2.26)	22.18 (3.38)	20.85 (4.58)
Mean BSA (m^2)	1.67 (0.17)	1.54 (0.2)	1.56 (0.16)
Mean Systolic BP (mmHg)	158 (57.4)	122.86 (20.17)	98.57 (20.07)
Mean Diastolic BP (mmHg)	96.57 (29.13)	82.86 (12.3)	62.86 (15.54)
Mean WHR	0.91 (0.02)	0.97 (0.1)	0.95 (0.07)
Mean body weight (kg)	60 (10.27)	55.19 (10.55)	54.8 (11.3)
Mean waist circumference	80.42(5.52)	82.57 (8.8)	80.57 (11.14)
Smoking (%)	57	70	69.56
Obesity (%)	0	5	4.34
Overweight (%)	42.8	10	0
Central obesity (%)	14.3	60	13.04

Table III. Mean values of lipid profile parameters in subjects consuming different lifetime intake amount of alcohol: (A – < 250 kg, B – 250 –500 Kg and C - > 500 Kg).

Characteristic	Group A (n = 7)	Group B (n = 20)	Group C (n = 23)	P value
TC	175.57 (19)	173.81 (75.14)	157.14 (34.2)	>0.05
HDL	43.86 (7.82)	47.1 (7.32)	44 (6.2)	>0.05
LDL	101.29 (13.33)	94.83 (15.34)	90.62 (22.90)	>0.05
VLDL	36.54 (9.86)	39.17 (15.03)	40.95 (16.34)	>0.05
TG	182.71 (49.28)	195.86 (75.14)	204.76 (81.72)	>0.05
Non HDL	131.71 (23.38)	126.71 (43.52)	113.1 (33)	>0.05

In another analysis, these lipid parameters and various confounding parameters were compared between male and female alcoholic subjects. Majority of females had central obesity (62.5 %) and also had higher waist circumference. Other parameters were comparable in these groups. The comparison of lipid parameters in male and female subjects of the study also showed similar level of total cholesterol, HDL, LDL and non-HDL cholesterol levels. The level of TG was higher in male subjects. Central obesity was more common in female subjects. Despite low life time intake amount in female they had similar type of lipid parameters as those of male with higher life time intake.

In another subanalysis, the lipid parameters were compared between smoker and nonsmoker alcoholic subjects. It shows no significant difference between these groups (Fig).
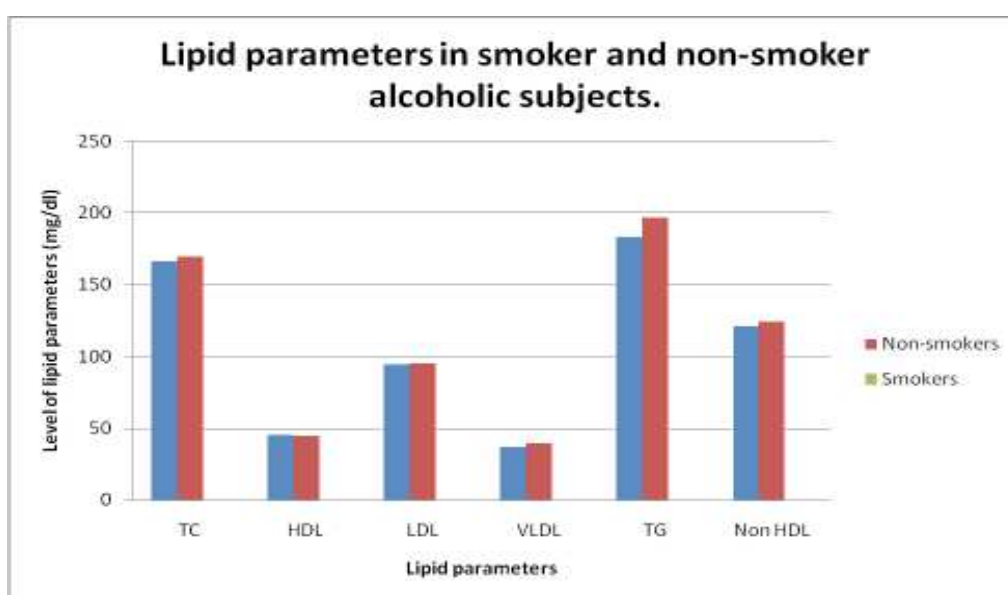

Fig. Mean Value of lipid parameters in smoker and non smoker alcoholic subjects.

A correlation analysis between total lifetime amount, daily amount and duration of alcohol consumption amount and HDL, LDL and triglycerides did not show any relation. In addition, the correlation between lifetime intake amount and BMI or body weight was also non-conclusive.

Discussion

This study was focused on lipid profile assessment in subjects 'at risk drinking'[17] of alcohol for prolonged duration and analyzed in reference to normal parameters. Majority of these subjects had desired level of total cholesterol (80 %). Sixteen percent have borderline high TC level and only 4% had high level of total cholesterol. Regarding LDL level, 60 % had optimal level of LDL. Remaining 38 % and 2 % had near optimal and borderline high level of LDL cholesterol respectively. No one had high or very high level of LDL cholesterol. Similarly, only 22 % and 6 % had low and high level of HDL respectively and majority (72 %) had normal level of HDL cholesterol. In addition, Forty percent of these subjects had high level of TG and 38 % and 22 % had normal and borderline high level of TG respectively. Regarding the non-HDL cholesterol, only 12 % had high and remaining 88 % had optimal level.

Daer et al [27] conducted a controlled diet study to establish the effect of moderate alcohol consumption on lipid profiles of postmenopausal women. Fifty-three, healthy, postmenopausal women served as subjects in this crossover design study. Each of the three, controlled diet periods was eight weeks in duration and each period was preceded by a two- to five-week alcohol free period without any other diet restrictions. The control diet provided approximately 15 %, 53 %, and 32 % of energy from protein, carbohydrate, and fat respectively, in line with the current typical American diet. In addition to the diet, the amount of alcohol in each treatment was fixed at 0 (control), 15, or 30 g per day for all subjects. Alcohol was provided with 340 g of orange juice. Each day, the subjects completed a questionnaire detailing beverage intake, factors related to dietary compliance, exercise performed, medications taken, illnesses incurred, and questions or problems with the diets. Fasting blood samples were taken at the start of controlled feeding and during the eighth week of the three controlled alcohol treatment periods and analyzed for serum lipid levels. When compared with concentrations following the control diet, plasma LDL cholesterol decreased from 3.45 to 3.34 mmol/l and triglyceride decreased from 1.43 to 1.34 mmol/l following 15 g of alcohol per day. There were no additional significant decreases observed in lipid levels following an increase in alcohol intake from 15 g to 30 g per day. Plasma HDL cholesterol increased non significantly from 1.40 to 1.43 mmol/l after 15 g of alcohol per day and significantly increased to 1.48 mmol/l after 30 g of alcohol per day (P=0.02). So it appeared that consumption of 15-30 g of alcohol per day by postmenopausal women may decrease the risk of cardiovascular disease by improving lipid profiles, even when not following a diet low in fat.

There are other early observational studies[28-31] showing an association between moderate alcohol consumption and decreased risk for cardiovascular

disease (CVD). The putative mechanism of decreased CVD is mostly explained by the fact that the moderate alcohol consumption had been shown to be associated with improvement in lipid parameters. In 1992,[32] a term 'French Paradox' was introduced as the relatively low incidence of CVD in the French population, despite a relatively high dietary intake of saturated fats, and potentially attributable to the consumption of red wine. After nearly 20 years, several studies have investigated the fascinating, overwhelmingly positive biological and clinical associations of red wine consumption with cardiovascular disease and mortality. Red wine components, especially alcohol, resveratrol, and other polyphenolic compounds, may decrease oxidative stress, enhance cholesterol efflux from vessel walls, mainly by increasing levels of high-density lipoprotein cholesterol, and inhibit lipoproteins oxidation, macrophage cholesterol accumulation, and foam-cell formation. These components may also increase nitric oxide bioavailability, thereby antagonizing the development of endothelial dysfunction, decrease blood viscosity, improve insulin sensitivity, counteract platelet hyperactivity, inhibit platelet adhesion to fibrinogen-coated surfaces, and decrease plasma levels of von Willebrand factor, fibrinogen, and coagulation factor VII. Light to moderate red wine consumption is also associated with a favorable genetic modulation of fibrinolytic proteins, ultimately increasing the surface-localized endothelial cell fibrinolysis.

This study showed favorable lipid parameters in alcoholic subjects except the higher level of triglyceride. The study showed optimal level of HDL level in majority of these subjects. These features are in the line of the notion of cardio protective effect of alcohol consumption by maintaining the level of LDL and HDL with an expense of slightly raised triglyceride level.

However, there was no relation between life time intake amount and BMI or body weight. This was in contrast to other studies where either negative or positive effect on BMI and obesity had been reported. In some study the alcohol consumption has been found to be associated with increased BMI and other metabolic abnormalities.[27] The speculative benefits of alcohol consumption through improvement in lipid parameters cannot overcome the negative contribution of body weight because, as a group, overweight individuals have higher prevalence of metabolic disturbances, including insulin resistance, dyslipidemia, glucose intolerance, and hypertension.[33] Hypertension was also more common in a group of subjects with life time intake amount less than 250 Kg. Other studies[34,35] had also concluded that moderate alcohol drinkers have a lower BMI and lower prevalence of overweight and obesity than nondrinkers or mild drinkers. In fact, one study[35] suggested that moderate alcohol consumption may be used to control body weight.

But there is a remarkable difference in our study and other previous studies. Most of these studies were done on moderate alcohol consumption. Our study is on non-moderate drinking subjects and showed that even the non-moderate drinking might have lipid friendly properties except increased triglyceride level. So our study is unique in various

aspects. Firstly, it shows lipid friendly effects of non moderate drinking regarding total cholesterol, HDL and LDL cholesterol. However, its impact in triglyceride level is deleterious. Secondly its effect of lowering LDL and increasing HDL cholesterol persist even at higher amount of alcohol intake in the expenses of higher triglyceride level. This is similar to the trend evident in moderate drinking. Thirdly, our study also shows that the effects of alcohol consumption on lipid parameters are independent to the sex and smoking status; however the lower life time intake amount in female does similar kind of effects as higher dose in male.

Our study has some limitations inherent to its descriptive nature and small samples. As we do not know the values of lipid parameters in normal nonalcoholic healthy subjects in our population and these lipid values were compared with normal standard values, any conclusion favoring to alcohol consumption based on this study will be misleading.

In overall, the 'French paradox' may have its basis for the conclusion in favor of cardiovascular benefits of alcohol consumption. These beneficial effects might be primarily attributable to combined, additive, or perhaps synergistic effects of alcohol and other wine components on atherogenesis, coagulation, and fibrinolysis. On the other hand, non-moderate drinking, while it does not seem to have deleterious effects on lipid parameters, will increase triglycerides and causes damage to the liver, brain, and heart. Therefore, there is no compelling evidence for health care professionals to suggest that nondrinkers begin consuming alcohol on medical grounds. Moreover, there is no evidence that there is an additional benefit with the increased amount of alcohol consumption.

In conclusion, although mounting evidence strongly supports beneficial cardiovascular effects of moderate drinking (one to two drinks i.e. 12-24gm alcohol per day) in most populations and the impact of non moderate drinking on lipid parameters is favorable, the overall benefit in cardiovascular health is conflicting. Any clinical advice to abstainers to initiate daily alcohol consumption has not yet been substantiated in the researches and literature and must be considered with caution on an individual basis.

Acknowledgement

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