

Blood viscosity of individuals with alcohol abuse

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Abstract

Aim: Alcohol abuse is accepted as a serious public health problem worldwide, and is a well-known cause of systemic alterations in the organism. The aim of our study is to investigate whether heavy alcohol consumption results in increased blood viscosity in men. We compared the levels of blood viscosity with the age-matched healthy male volunteers.

Material and Methods: In order to study the blood rheology of alcohol abusers, we measured blood viscosity in 20 male patients prior to the detoxification treatment. Blood viscosity measurement was performed using Harkness Capillary viscometer.

Results: Comparison of blood viscosity yielded a statistically significant elevation ($p < 0.001$) for alcoholic individuals.

Conclusion: We conclude that, among other factors causing cardiovascular diseases, such as increased blood fibrinogen and triglyceride levels, increase in blood viscosity due to chronic heavy alcohol consumption is an exacerbating factor for coronary diseases in alcoholic individuals.

Keywords: Alcohol Abuse; Blood Viscosity; Plasma Viscosity.

INTRODUCTION

Alcohol abuse is accepted as a serious public health problem worldwide. The complications arise from chronic alcohol consumption depend on the length of exposure and dosage. Chronic alcohol abuse causes problems of different organs and organ systems, mainly liver, brain, and circulatory system (1).

Epidemiological studies showed a highly positive correlation between cardiovascular events and chronic alcohol consumption. Alcohol has been shown to increase serum osmolality, which results in shrinkage of red blood cells, resulting in increase of blood viscosity (2). Besides dehydration, factors such as hyperlipidemia, dyslipidemia, increased fibrinogen levels, inflammatory processes on the endothelium and diabetes mellitus cause increased plasma viscosity (3).

In the capillaries with a diameter less than 30 μm , the total resistance is greater than the larger vessels up to 7-fold as a result of Hagen–Poiseuille equation (4). Blood viscosity is one of the components of this equation and directly contributes in the vessel resistance, resulting decreased coronary blood flow, hence myocardial ischemia.

The aim of our study is to investigate whether heavy

alcohol consumption results in increased blood viscosity in men. We compared the levels of blood viscosity with the age-matched healthy male volunteers.

MATERIAL and METHODS

Twenty male patients with chronic consumption of alcohol more than ≥ 80 g/day ethanol, and age-related 20 healthy non-alcohol abusing male controls were enrolled in the study group. The mean age of the subjects in the study group was 41, ranging from 32 to 48 years. Subjects have been internalized in a center for substance abuse, and blood samples have been withdrawn prior to the detoxification treatment. Individuals abusing different kind of substances such as drugs, synthetic narcotics and/or pharmacological and psychotropic substances have been excluded.

The study was approved by the ethical committee of Istanbul University Cerrahpaşa Medical Faculty (Approval No: 1674). All participating patients provided informed consent, and the study was performed according to the Helsinki Declaration.

Laboratory analysis

All experiments were carried out in the laboratories of Istanbul University Cerrahpasa, Cerrahpasa Medical

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Medical Faculty, Department of Biophysics. Blood viscosity measurement was performed using Harkness Capillary viscometer. EDTA blood samples were kept at room temperature on an automatic mixer following the withdrawal and analyzed within 2 hours. The viscometers were calibrated were used before the measurements. The flow rate, measured in seconds (s), of each blood sample was compared with distilled water.

Statistical analysis

Statistical evaluations of control and patient groups were performed with the Student's t test using Statistical Package for Social Sciences (SPSS)-11.0 versions. The results were presented as mean \pm standard deviation. Significance level was accepted as $p < 0.05$. Comparison graph was drawn using the Med-Calc statistical program.

RESULTS

The mean blood viscosity of the study group was 3.02 cp with a standard deviation (SD) of 0.36 cp. The mean viscosity of the control group was 2.71 cp with a SD of 0.47 cp. The difference between the study and the control group was statistically significant ($p < 0.001$) (Table 1). The distribution of the values between two groups was shown in Figure 1.

Table 1. Results blood viscosity measurements of control and patient groups (M-mean, SD-standard deviation)

	Study group (M \pm SD)	Control group (M \pm SD)	p value
Blood Viscosity (cp)	3.02 \pm 0.36	2.71 \pm 0.47	<0.001*

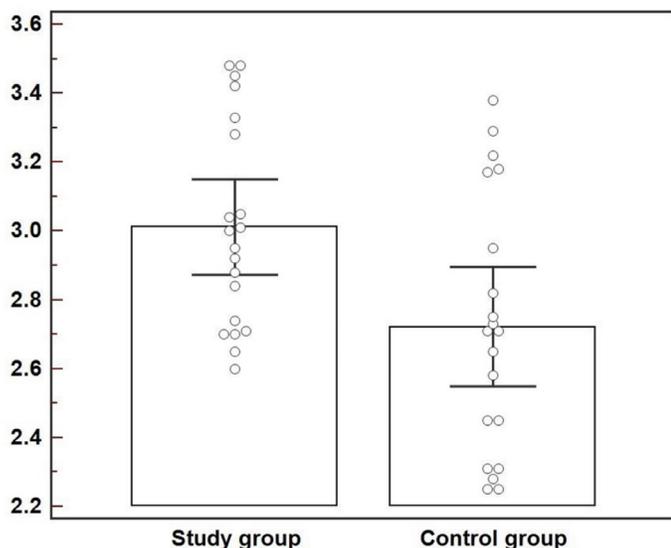


Figure 1. Comparison graph of values between the study and the control group

DISCUSSION

Alcohol consumption has been known to affect the hemorheological pattern of the blood. However, the issue of whether it increases or decreases the blood viscosity is debated. In the present study, we aimed to measure blood viscosity in chronic alcohol consumers, who

abused alcohol to a large extent and hospitalized due to alcoholism. We also compared the blood viscosity of study subjects with the age and gender-matched healthy controls and found a statistically significant increase in blood viscosity of alcohol abusing individuals.

In a study with non-alcoholic consumers, red wine drinking with an amount of 4.36 ml/kg body weight increased blood viscosity only at a standardized hematocrit value of 45%. For individuals with lesser hematocrit percentages, there was no significant difference between the controls and the subjects (5). A mild level of alcohol consumption for up to two weeks duration did not affect the plasma viscosity (6). However, there are controversial studies which report increased plasma viscosity in chronic alcohol consumers, thus, the alterations in the plasma viscosity of alcoholic subjects might be a result of heavy consumption for a long duration (7,8).

Although there are studies claiming that the occurrence rate of coronary heart disease, stroke and myocardium infarct has been decreased in individuals who drink 10-20 grams of alcohol per day, heavy alcohol consumption is a well-known cause of cardiovascular event and mortality (5,9).

Blood viscosity is determined by several factors as hematocrit value, red blood cell deformability, and serum total protein level, the concentration of the lipids in the circulation and blood fibrinogen level (3). There are studies reporting alcohol intake reduces fibrinogen levels, which is an increased risk factor for cardiac diseases (10). On the other hand, how often and how much alcohol consumption has a lowering effect on fibrinogen levels is still unclear.

Accumulated evidence concludes that alcohol inhibits platelet aggregation by inhibiting the production of arachidonic acid-derived thromboxane-A2 resulting in decreased coronary heart disease ratio (11). Despite increasing the HDL-cholesterol levels, alcohol has been shown to increase blood triglyceride levels (12). Increased blood cholesterol and triglyceride levels trigger the vascular deformities in alcoholic individuals alongside their role in increased blood viscosity. Thus, chronic alcoholism might be increasing cardiovascular disease or stroke risk via increasing viscosity, resulting in induced shear stress on the vessel wall.

In our study, the measurements of blood viscosity were made using non-fasting blood samples from both the study and control subjects. It is possible that fasting blood samples might cause different results. Additionally, sampling time varied between the individuals, since we withdrew blood in the time of hospital admission prior to detoxification treatment. Blood rheology is affected by daily changes following a circadian rhythm. Hence, a definite sampling time for all subjects might have yielded different results.

We did not measure the plasma osmolality and blood hematocrit value in our subjects. Dehydration is a result

of alcohol intake, and increased blood viscosity in our study group may be caused from dehydration and hemoconcentration. The study and the control groups in our study were consisted of male individuals, since hormonal alterations in female subjects can affect the blood viscosity (13).

CONCLUSION

In conclusion, although we found increased blood viscosity in chronic alcoholic individuals, a simultaneous study measuring the parameters that effect blood rheology, e.g. plasma osmolality, total protein and albumin levels, lipid status, fibrinogen concentration might contribute a better understanding of the rheology pattern in alcohol imbibers.

Competing interests: The authors declare that they have no competing interest.

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