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## **Resting Heart Rate, Heart Rate Variability and Electrocardiogram Changes In Chronic Alcoholics**

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### **Abstract**

**Aim:** Alcohol use is causing damage to the health. The damage may be physical or mental. Recent studies strongly suggest that long-term, alcohol abuse may have powerful implications on cardiovascular health. However, very few studies have focused on the association between long-term alcohol drinking and resting heart rate, Heart rate variability and electrocardiogram changes at rest in these individuals. Thus, the present study was conducted to establish the electrocardiogram changes, heart rate and heart rate variability in chronic alcoholics at rest and to compare the changes with that of non-alcoholic controls.

**Methods:** The study group consists of Fifty men, aged between 30-50 years with alcohol intake for more than 5 years of duration, without any known cardiac illness. Similarly, Fifty non-alcoholic individuals of the same age, sex and anthropometrically matched group constitute the control group. Resting heart rate was recorded while heart rate variability and ECG were monitored and recorded by using ECG –DYNATRAC system. Statistical analysis was done by using student ‘t’ test.

**Result:** *In the present study, there was a significantly high resting heart rate (tachycardia) and decreased heart rate variability in alcoholics compared to non-alcoholics. ECG in them showed significant decrease in RR interval. However, all other ECG waves, intervals and QRS frontal axis were unchanged in them compared to controls.*

**Conclusion:** *Long-term alcohol intake has deleterious effects on cardiovascular functions as it leads to increased resting heart rate, decreased HRV and ECG changes. These findings may be an early indicator of the 'alcohol abuse' on body system, especially on the cardiovascular system.*

**Key words:** *Electrocardiogram; Heart rate variability; Resting heart rate; Chronic alcoholics.*

## INTRODUCTION

'Alcoholic' is a person, who has a compulsion to drink, exhibits prominent 'drink-seeking behavior', becomes tolerant to alcohol and has obvious physical, psychological and social problems related thereto <sup>(1)</sup>. Alcohol is a psychoactive drug, which has a depressant effect. High alcohol content in the blood reduces the attention and slows the reaction speed <sup>(2)</sup>. Alcoholism is called dual disease since; it includes both mental and physical components. Significant alcohol intake produces changes in the brain's structure and chemistry <sup>(2)</sup>.

Chronic and heavy alcohol consumption has deleterious effects upon the cardiovascular system and may lead to progressive, chronic cardiac dysfunction such as heart muscle disorders (cardiomyopathy), heartbeat rhythm irregularities (arrhythmias), high blood pressure (hypertension) and stroke <sup>(3)</sup>. Most of the previous observations relate the abnormal electrocardiogram (ECG) to the organic myocardial diseases. However, ECG changes may occur in chronic alcoholics without any corresponding cardiomyopathy <sup>(4)</sup>.

A few of previous studies have shown that there is a high pulse rate and Heart rate variability and

the presence of abnormal electrocardiogram at rest in different pathological conditions, but not essentially in apparently healthy chronic alcoholics <sup>(5)</sup>.

Thus, the present study was conducted to establish the electrocardiogram changes and Heart rate variability (HRV) in chronic alcoholics at rest and to compare the changes with non-alcoholic control individuals.

## MATERIALS AND METHODS

The present study was conducted by monitoring and recording heart rate, HRV and ECG in a 'DYNATRAC' system in study subjects (chronic alcoholics) and controls (non-alcoholics), residing in and around Hubli City. The study was conducted in the department of Physiology with the assistance of Medicine department, 'KIMS', Hubli. The study and its conduct were cleared by the ethical committee, 'KIMS', Hubli.

The study group consists of Fifty men, aged between 30-50 years with alcohol intake for more than 5 years of duration, without any known cardiac illness. Similarly, Fifty non-alcoholic individuals of the same age, sex and

anthropometrically matched group constitute the control group.

All the inclusion and exclusion criteria were considered while selecting the study subjects. The approximate number of alcoholic drinks consumed per month and duration of consumption was considered. Height and weight of each individual was recorded, while BMI was calculated. Vital parameters like pulse rate, arterial blood pressure were recorded. A detailed clinical examination of respiratory, cardiovascular, per abdomen and central nervous system was conducted. Resting heart rate was recorded while, HRV and ECG was monitored and recorded in a ECG- 'DYNATRAC' system.

### Statistical analysis

Statistical analysis of the resting heart rate, electrocardiogram changes and HRV in alcoholics

and controls were done by student "t" test. P value < 0.05 was considered as 'significant' in this study.

### RESULTS

Important characteristics of resting heart rate, ECG and HRV in study (alcoholics) and control (non-alcoholic) groups are presented in this section.

The mean ( $\pm$  SD) resting heart rate in control was  $90.56 \pm 15.53$  beats /min and in alcoholics, it was  $100.80 \pm 23.56$ beats/min. Thus, the resting heart rate was insignificantly higher in alcoholics, compared to that of controls (Table. 1).

The mean ( $\pm$  SD) HRV at rest in control was  $4.9 \pm 1.0$  beats /min and in alcoholics, it was  $3.8 \pm 1.3$ beats/min. Thus, Heart rate variability at rest was significantly decreased in alcoholics, compared to that of controls (Table. 1).

**TABLE. 1.** Comparison of Resting heart rate and Heart rate variability in Alcoholics with Controls [Non-alcoholics].

Parameter (beats/min)	Control	Alcoholics	't' value	'P' value	Significance
Resting heart rate	90.56 $\pm 15.53$	100.80 $\pm 23.56$	2.56	< 0.05	<b>S</b>
HRV	4.9 $\pm$ 1.0	3.8 $\pm$ 1.3	2.25	< 0.05	<b>S</b>

Data expressed as Mean  $\pm$  SD. (n=50). P < 0.05- Significant (S). P < 0.01- Highly Significant (HS).

Most important finding in ECG in the chronic alcoholics at rest was a significant decrease in RR interval. However, all other ECG waves and

intervals as well as QRS frontal axis were unchanged in them (Table.2).

The mean ( $\pm$  SD) RR interval at rest in control was  $0.67 \pm 0.07$ seconds and in alcoholics, it was  $0.60 \pm 0.9$  seconds. Thus, RR interval was significantly decreased in alcoholics, compared to that of controls.

**TABLE. 2.** Comparison of ECG Changes in Alcoholics at rest with ECG of Controls [Non-alcoholics].

Parameters (seconds)	Control	Alcoholics	't' value	'P' value	Significance
P wave	0.09 ± 0.04	0.09 ± 0.01	1.509	> 0.05	NS
QRS Complex	0.07 ± 0.01	0.08 ± 0.03	1.002	> 0.05	NS
T wave	0.09 ± 0.05	0.10 ± 0.02	1.437	> 0.05	NS
PR Interval	0.12 ± 0.02	0.13 ± 0.06	1.927	> 0.05	NS
ST Segment	0.34 ± 0.01	0.32 ± 0.01	1.579	> 0.05	NS
QT Interval	0.41 ± 0.04	0.40 ± 0.02	0.614	> 0.05	NS
QTc Interval	0.40 ± 0.06	0.41 ± 0.07	0.794	> 0.05	NS
RR Interval	0.67 ± 0.07	0.60 ± 0.9	2.064	< 0.05	<b>S</b>
TP Interval	0.21 ± 0.09	0.18 ± 0.10	1.754	> 0.05	NS

Data expressed as Mean ± SD. (n=50). P < 0.05- Significant (S). P < 0.01- Highly Significant (HS). The mean (± SD) QRS frontal axis during at rest in control was 61.10 ± 18.70 degrees and in

alcoholics, it was 59.60 ± 21.00 degrees. Thus, QRS frontal axis was significantly unchanged in alcoholics, compared to that of controls (Table. 3).

**TABLE. 3.** Comparison of QRS frontal axis in Alcoholics at rest with Controls [Non-alcoholics].

Parameter (degree)	Control	Alcoholics	't' value	'P' value	Significance
QRS frontal Axis (Degree)	61.10 ± 18.70	59.60 ± 21.00	0.753	> 0.05	NS

Data expressed as Mean ± SD. (n=50). P < 0.05- Significant (S). P < 0.01- Highly Significant (HS).

## DISCUSSION

Alcohol has been used as a beverage around the world and in India for centuries. Its easy availability in the recent years, as a common commodity has lead to myriad of problems affecting the social and physical health of individuals and society.

In the present study, it was observed that there was an increased heart rate (tachycardia) even at rest in alcoholic subjects, compared to the non-alcoholic individuals. This finding correlates with the previous study done by Ryan et al.,<sup>(6)</sup> in

which it was showed that there is an increase in resting heart rate in alcoholics. They concluded their study with a conclusion that, the alcohol consumption is always associated with reduced vagal activity and there may be a positive association between alcohol intake and heart rate. In another study Morvai et al., showed that about 46.8 % of alcoholics, with no heart disease found with sinus tachycardia and ECG abnormalities<sup>(7)</sup>. Excessive consumption of alcohol in the absence of underlying organic heart disease may produce electrocardiographic abnormalities. These

abnormalities may imitate the changes produced by coronary artery diseases, although the prognostic significance of the abnormal electrocardiogram would be quite different. Electrocardiographic findings in asymptomatic alcoholics are frequently abnormal and these findings may be the only indication of heart disease in these individuals<sup>(8)</sup>.

In a previous study by Trejbal et. al., it was concluded that, the ECG pattern very often shows nonspecific repolarization changes in ischemia, which is mostly asymptomatic in the form of silent myocardial ischemia and was worsened in alcohol-intoxicated ischemic heart disease patients. The resulting ECG may be influenced by many conditions, which often associates with inebriety, such as hypothermia, hypoglycemia to a large extent. There is convincing evidence that, not only the chronic alcoholism, but also single episode of excessive alcohol consumption is associated with increased cardiovascular mortality<sup>(9)</sup>.

In the present study, there were no significant ECG changes observed, including QRS frontal axis in chronic alcoholics at rest. However, in these individuals RR intervals and HRV were decreased significantly compared to non-alcoholics.

This finding with RR interval (shortened) may be due to increased resting heart rate in these individuals compared to non-alcoholics rather than shortened duration of different ECG waves and intervals.

Heart rate variability (HRV), the variation over a time of period between consecutive heart beats, is

predominantly dependent on the extrinsic regulation of the heart rate. It is a non invasive electrocardiographic marker, reflecting the activity of the sympathetic and vagal components of the ANS on the sinus node of the heart. It expresses the total amount of variations of both instantaneous heart rate and RR intervals<sup>(10)</sup>.

In the present study, there was a decrease in HRV in the alcoholics compared to control even at rest. This association between alcohol intake and decreased resting HRV may be due to a central or peripheral effect of alcohol on cardiac vagal activity.

The findings of this study confirm the previously reported, universe associations between alcohol intake and HRV, which have shown that the alcohol consumption is associated with reduced vagal activity, which increases the resting heart rate and decreases the heart rate variability<sup>(11)</sup>.

## CONCLUSION

The present study concludes with the following important findings, which will bear significant importance regarding the awareness and prevention of alcohol induced diseases.

It was observed that, there was an increased resting heart rate ( tachycardia) and decreased HRV in alcoholics compared to non- alcoholics. Furthermore, the changes in the electrocardiogram in alcoholics at rest include shortening of RR interval. However, all other parameters of ECG, including QRS frontal axis were unchanged in these alcoholic individuals.

Thus, the present study can be concluded with the findings that the alcohol consumption for more

than 5 years of duration produces significant changes in resting heart rate, HRV and electrocardiogram. These changes may be considered as an early indicator of the effects of alcohol abuse on cardiovascular system. Precautions need to be taken in the alcohol abusers in the form of complete stoppage of alcohol consumption or moderation of alcohol consumption to prevent the onset of irreversible alcohol induced cardiovascular diseases.

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