

Research Article

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**Electrocardiogram Change and Chronic Alcohol Consumption**

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**Abstract**

**Background:** The electrocardiogram (ECG) is an important, available, and inexpensive diagnostic tool to assess cardiac symptoms. Evidence reveals that chronic consumption of alcohol can lower the contractile forces of heart and may contribute to congestive heart failure which is known as ‘‘alcoholic cardiomyopathy’’ the heart is enlarged and weakened and the individual experience unusual fatigue with physical effort(1). Result showed that chronic alcohol consumption, in the absence heart disease may alter ECG. However; very few studies have focused on effect of alcohol on the electrocardiogram.

**Objective:** To effect of alcohol on the electrocardiogram in Jimma town, Southwest Ethiopia.

**Method:** In this study, a community based cross-sectional survey on the representative sample of 342 persons, age >18 years, was conducted in Jimma town, southwestern Ethiopia, from March to April 2016. Sociodemographic characteristics, alcohol consumption history and ECG record by using standard 12-lead, data were collected. Lottery method was used to select one member of a family in each household. Collected data was checked for its completeness and coded then entered to Epi-data 3.1 version and then exported to SPSS version 20 window for analysis. Descriptive statistics, binary and multivariate logistic regression analyses were applied to compute the variables.

**Results:** Electrocardiography was performed in 326 people were examined and analyzed .Prevalence of alcohol consumption 82(25.2) There was a significant statistical association between alcohol consumption and ECG alteration. The most prevalent altered ECG finding was high heart rate 28(51.85%).

**Conclusion:** Out of the 326 participant studied, 59(18.1%) had ECG change. Prevalence of alcohol consumption 53(32.4%)

**Recommendation:** Health promotion interventions should aim to prevent cardiovascular system diseases and regular screening in community.

**Keywords:** ECG, Alcohol consumption.

**Introduction**

**Theoretical background and statement of the problem**

The 12-lead electrocardiogram (ECG) is a low-cost and readily available tool that provides important diagnostic cardiovascular information (2). After its introduction into clinical practice, the electrocardiogram (ECG) remains one of the most commonly used tests for the assessment of cardiac disease(3).

ECG changes may occur in chronic alcoholic persons without any corresponding cardiomyopathy. Excessive consumption of alcohol in the absence of underlying organic heart disease may produce electrocardiogram abnormalities(4).

Binge drinking and continued **alcohol** use in large amounts are associated with many **health problems**, including: High blood pressure, stroke, and other heart-related diseases(1). Harmful effects

of heavy alcohol drinking increased risk for heart muscle disease (i.e., alcoholic cardiomyopathy), increased risk for disturbed heart rhythm (i.e., arrhythmia), increased risk for high blood pressure and increased risk for hemorrhagic stroke (5). Alcohol dependence is a common problem being diagnosed in up to 25% outpatient hospitalized patients(6). The mechanism of alcohol-induced ECG change, possible changes in adrenergic activity in healthy subjects during acute alcohol intake and withdrawal, but after prolonged heavy drinking a down-regulation of-adrenoceptors and/or elevation of circulating catecholamines is seen both in animal experiments and in human(7,8). Most important findings in ECG in the chronic alcoholic persons during moderate exercise include significant changes in ST, QT, and QTc intervals(6). The epidemiology

of cardiovascular diseases in Africa, reported mainly on hospitalized patients, may not represent the true pattern of heart disease in the continent. Ethiopia as one of the African countries also shares the burden of cardiac disease. Some studies conducted in the country indicated that the two major causes of cardiac disease are RHD and HHD furthermore IHD is on the rise(9).

The previous studies more concerned about the effect of chronic alcohol consumption on the liver disease, such as cirrhosis. The present study will apparently enrich previous findings and give further clearing on the ECG change and chronic alcohol consumption in the study area. So far there is no community based study that has been done in the study area to assess ECG change and the chronic alcohol consumption.

## Literature Review

### ECG and Alcohol

Drinking too much alcohol can raise the levels of some fats in the blood (triglycerides). Alcohol's perturbing effect on fibrinolytic proteins may involve its effects on modifiers that influence fibrinolytic activity, such as the serum level of triglycerides. An increase in triglyceride level is positively correlated with PAI-1 plasma levels, indicating a predisposition to thrombosis and atherogenesis (5) Because the liver is reported to be the major site of apoA-I synthesis and because alcohol increases apoA-I production in transformed human hepatocytes, It can also lead to high blood pressure, heart failure and an increased calorie intake. Consuming too high calories can lead to obesity and a higher risk of developing diabetes (10). Most important findings in ECG in the chronic alcoholic persons during moderate exercise include significant changes in ST, QT, and QT intervals. However, all other ECG waves and intervals were unchanged in them (4). Excessive drinking and binge drinking can lead to stroke. According to Klatsky study reported that increasing intake of alcohol leads to cardiomyopathy and non specific ST-T changes in ECG (6). Other serious problems which change the ECG pattern include fetal alcohol syndrome like cardiomyopathy, cardiac arrhythmia and sudden cardiac death.

The epidemiology of cardiovascular diseases in Africa, reported mainly on hospitalized patients, may not represent the true pattern of heart disease in the continent. Ethiopia as one of the African countries also shares the burden of cardiac disease. Some studies conducted in the country indicated that the two major causes of cardiac disease are RHD and HHD furthermore IHD is on the rise. So far there is no community based study that has been done in Jimma town to determine the association between ECG alteration and substance use.

## Methods and Material

### Study Design

Community based cross-sectional study was employed

The study population was all sampled people of Jimma town 18years and above.

### Sample Size Determination and Sampling Techniques

Sample size was determined using single population proportion formula taking an estimated 17 % of ECG alteration from the study done in Addis Ababa (11) with the assumption of 95 % CI.  $n$  = the desired sample size

$z$  = the standard normal deviate, set at 1.96 which corresponds to

95% confidence level,

$p = 17\%$  the proportion of ECG alteration. This gives as maximum sample size

$d =$  Permitted error (5%, for the confidence level is 95%)

Therefore  $n = 1.96 * 1.96 * (0.17 * 0.83) / (0.05 * 0.05) = 217$

$N = 217 * 1.5 = 326$

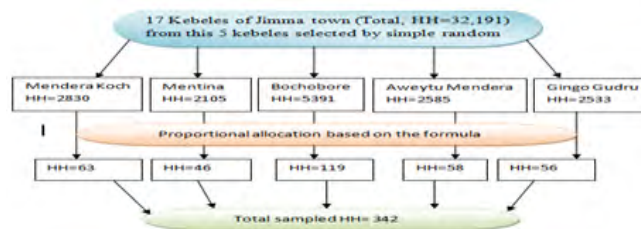
Systematic multistage sampling methods was used .By adding non-response rate of 5% and design effect of 1.5 Therefore, the total sample size of the study was 342

Then after, sample was proportionally allocated in each sub group using the formula,  $n_j = n/N * N_j$

where,  $n$ =HH sample size= 342

$N$ =total HH= 15444

$N_j$ = total number of HH in each Kebeles,



**Figure 1:** showing Systematic multistage sampling of each Kebeles

### Operational Definition

• **Alcohol drinker:** in this study shall mean those who drink  $\geq 3$ -6 drink beer per occasion and experienced some alcohol related problem.

• **Non- drinker:** in this study shall mean those who drink  $\leq 2$  beer for men,  $\leq 1$ beer for women and those who drink occasionally during ceremony or other time.

• **Chronic Alcohol Use:** defines heavy alcohol use as binge drinking on 5 or more days in the past month

### Data Collection Material

• Interviewer –administered questionnaire was used.

• Digital self interpreting Electrocardiography

### Recording of ECG

**Machine:** Standard 12-lead Electrocardiography, MODEL NO .YSIPL-155

### Data Analysis Procedure

After checking the collected data for completeness, it was entered in to Epi-data version 3.1 and exported to SPSS version 20 for windows. Descriptive statistics, binary and multivariate logistic regression were employed to see associations of dependent and independent variables. Then p-value less than 0.05 were set to determine significantly associated variables.

## Results

### Descriptive Characteristics of the Study subjects:

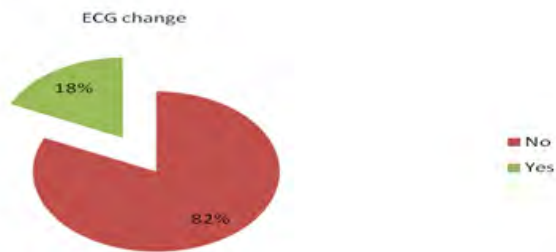
In this study 342 study subjects were planned of which 326 subjects were participated with response rate of 95.3%, while. Among all participants, 201(61.7%) were males. The mean age of study participants was 33.98years (SD  $\pm$  15.72). Majority of study participants were in the age range of 18-24 followed by 25-35 years which accounted for 45.4%.and 20.6%, respectively. Majority of the study subjects 122(37.4%) were in the range of high income

categories when we compare with mean monthly income of participant (1360.50 birr). Regarding ethnicity, 207(63.5%) was Oromo followed by Amhara 73(22.4%). Concerning religion majority of the study subjects were Muslims 147(45.1%) next 126(38.7%) orthodox. Regarding educational status greater part of the study subjects were literate 266(81.6%). When we see occupational status majority of study subjects were employed 125(38.3%) followed by merchant 64(19.6%). Regarding the marital status of study subject, 184(56.4%) was married. Majority of the study subjects used substances 164(50.3%). In study area study subjects were used alcohol 53(32.4%).

**Table 1:** Sociodemographic characteristics of study among employs of Jimma University from March to April 2016

Variable	Category	Frequency	Percent
<b>Age</b>	18-24	148	45.4
	25-35	67	20.6
	35-49	52	16.0
	>=50	59	18.1
<b>Sex</b>	male	201	61.7
	female	125	38.3
<b>Religion</b>	orthodox	126	38.7
	Muslim	147	45.1
	protestant	38	11.7
	catholic	11	3.4
	others	4	1.2
<b>Ethnicity</b>	Oromo	207	63.5
	Amhara	73	22.4
	tiger	10	3.1
	keffa	26	8.0
	others	10	3.1
<b>Educational status</b>	illiterate	60	18.4
	primary	131	40.2
	secondary	50	15.3
	diploma	32	9.8
	first degree and above	53	16.3
<b>Marital status</b>	single	120	36.8
	married	184	56.4
	divorced	11	3.4
	widowed	11	3.4
	<b>Occupation</b>	employed	125
merchant		64	19.6
house wife		56	17.2
daily laborer		37	11.3
others		44	13.5
<b>Income</b>	<1000	174	53.4
	1000-2000	110	33.7
	>2000	42	12.9

As per table Fig: 2 show those ECG changed study subjects 59(18.1%) in age 18 years and above, Jimma town, March to April 2016



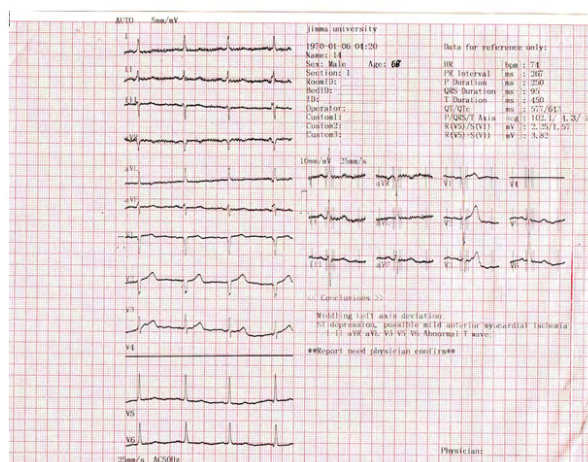
**Figure 2:** ECG change among study subject in age 18 years and above, Jimma town, March to April 2016.

As per table Fig: 3 show from those ECG changed study subjects 11(20.3%) had ST Segment deviation, 28(51.85%) had T-wave abnormality, 6(11.11%) had Prolongation of QT interval, 2(7.40%) had prolonged QRS interval, 5(5.56%) had R wave amplitude increased and 2(3.71 had Short PR interval.

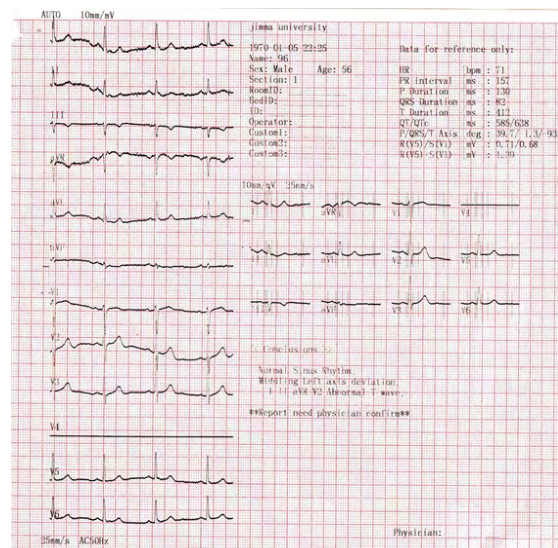


**Fig: 3** ECG waves change among study subject in Jimma town from March to April

As indicated on fig,4 and 5, ECG change finding in electrical axis abnormality, heart rate abnormality, arrhythmia, MI and Arial or ventricular hypertrophy which accounts for 6(11.11%), 28(51.85%), 3(5.56%), 9(16.67%) and 8(14.81%) respectively.



**Fig: 4** ECG waves change among study subject in Jimma town from March to April



**Figure 5:** ECG finding among study subject study in age 18 years and above, Jimma town, March to April 2016

### Multivariable logistic regression models independent variable ECG change of the study subject:

It was observed that age group 25-34 was nearly 5 times more likely to have ECG change than age group 18-24 years (AOR=4.669 [95% CI: 1.757, 12.411]). Similarly, study participants who drank alcohol life time were more than 2.55 times more likely to have ECG alteration than those not who did not drink alcohol life time (AOR=2.550 [95% CI: 1.110, 5.812]).

Model	B	P	AOR	95% C.I	
				Lower	Upper
Sex					
Female	-0.306	0.432	0.736	0.343	1.582
Male			1 <sup>r</sup>		
Age					
18-24			1 <sup>r</sup>		
25-34	1.541	<b>0.002</b>	4.669	1.757	12.411
35-49	0.623	0.270	1.865	0.616	5.640
≥50	0.446	0.453	1.562	0.488	5.001
Life time Alcohol Use					
Yes	0.936	<b>0.026</b>	2.55(1.12- 5.81)	1.119	5.812
No			1 <sup>r</sup>		

Bold =significant independent variables (at p<0.05), 1r=reference

**Table 5:** Multivariate logistic regression analysis for the association of different variable with ECG change among study subject in Jimma town from March to April/2016

### Discussion

Previous studies show that habitual alcohol drinking has adverse effects on the physical, physiological, economical and psychosocial well being of the productive section of the society(12). There are only very few communities based studies done in Ethiopia to determine ECG change and its association with substance use, sociodemographic characteristic, BP, body composition.

This study revealed that the prevalence of ECG change in Jimma town was 18.1% (n=59) out of a total of 326 subject. According to the present study significant association (p<0.046) was observed between chronic alcohol consumptions with ECG change. This study is in line with the study done by George Sereny ,the electrocardiographic findings in the1,000 patients he abnormalities ECG probably caused by excessive alcohol consumption fall into two main groups: sinus tachycardia and nonspecific T- wave changes. Cases with extra systoles, atrial fibrillation, and right or left bundle-branch block were too few to allow a valid conclusion about the etiology(13).

The possible explanation, the biochemical basis of alcohol induced cardiomyopathy disturbances in cardiac energy metabolism. For example, high blood concentrations of alcohol reduce the oxygen supply to the cardiac muscle and interfere with oxygen-requiring (i.e. aerobic) metabolism in the heart. This effect decreases the level of the high energy molecules that power the contraction process (i.e. adenosine triphosphate, ATP) as well as the level of another energy source, phosphocreatine. Several mechanisms have been identified to explain alcohol's negative effects on cardiac muscles. For example, when an electrical current spreads to the interior of cardiac muscle fibers, it causes the release of large quantities of calcium ions from a network of tubules (i.e., the sarcoplasmic reticulum), which in turn trigger the chemical events that produce muscular contractions.

Shortened the R-R interval (cardiac cycle length) by 9% and shortened the duration of ventricular depolarization and repolarization time (QT interval) by 4.5% (14).Harmful effects of heavy alcohol drinking increased risk for heart muscle disease (i.e., alcoholic

cardiomyopathy), increased risk for disturbed heart rhythm (i.e., arrhythmia), increased risk for high blood pressure and increased risk for hemorrhagic stroke (5). That entire cardiac problem can change the ECG pattern.

### Conclusion and Recommendation

#### Conclusion

This work and previous studies demonstrated that chronic alcohol consumption has an effect on ECG change.

#### Recommendation to health professionals

- Health promotion interventions should aim to prevent cardiovascular system diseases by regular screening program in general population. Policy makers should design strategies to control the production, usage and distribution alcohol.

- For this study because of the constraints of time, only cross sectional study design was employed which may be able to establish continues relationship among variables. So further researchers should apply longitudinal method to identify more relationship among variables for the long of time

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