

The Effect of Alcohol on the Electrocardiogram.

Cookey SN, Nwazor EO, Nnadi N.

Cookey S N

Consultant Cardiologist, Department of Internal Medicine,
Rivers State University Teaching Hospital
No 8-10 Harley Street, Old GRA
Port Harcourt, Rivers State

Nwazor EO

Consultant Neurologist, Department of Internal Medicine,
Rivers State University Teaching Hospital
No 8-10 Harley Street, Old GRA
Port Harcourt, Rivers State

Nnadi N

Consultant Family Physician, Department of Family Medicine.
Rivers State University Teaching Hospital
No 8-10 Harley Street, Old GRA
Port Harcourt, Rivers State.

Corresponding Author: Stella N. Cookey

Abstract

Introduction: There has been varied views of authors on the benefit of moderate alcohol consumption on cardiovascular diseases. Especially on the heart, moderate alcohol consumption has been said to be cardio protective, however, over time arguments have been on, and this view is being seen as a myth. Despite the arguments for moderate alcohol consumption, all parties agree that excessive alcohol consumption has a deleterious effect on the cardiovascular system. Electrocardiography has been used to evaluate cardiac abnormalities and is the gold standard in evaluating heart rhythm abnormalities. It has also been used to evaluate cardiac abnormalities in people that consume alcohol. This study set out to evaluate the effect of alcohol on the heart seen on Electrocardiography.

Method: Forty-seven male subjects who consented to be part of the studies had electrocardiography test, after filling a predesigned questionnaire; which provided information on their occupation, social habits, and history of alcohol consumption symptoms and clinical findings. The daily quantity of alcohol consumed was assessed and the study population was divided into 3 groups; based on amount of daily alcohol consumption to mild, moderate and excessive drinkers.

Results: Forty-seven (47) men consented to be part of the studies, with age range from 19yrs to 91yrs with mean of 32.85 ± 15.61 yr. Mean \pm SD BMI of 24.00 ± 3.11 kg/m², mean \pm SD of systolic blood pressure of 129.33 ± 20.01 mmHg and mean \pm SD diastolic blood pressure of 77.30 ± 14.50 mmHg, mean \pm SD daily value of alcohol consumed was 74.24 ± 43.34 g/day, The most common electrocardiographic abnormalities were arrhythmias; sinus tachycardia, sinus bradycardia, heart blocks, conduction delay. Other abnormalities noted were left ventricular hypertrophy (LVH). Left axis deviation, right ventricular hypertrophy (RVH), left and right atrial enlargement.

Conclusion: Fifty percent (50%) of those considered by the study to be Mild drinkers with daily intake of ≤ 50 g/day of alcohol showed abnormalities in their ECGs which were majorly arrhythmias. Also, fifty percent (50%) of those considered by the study to be moderate drinkers with daily intake of 50-100g/day had abnormal ECG with 3(13.64%) having multiple ECG abnormalities and Excessive alcohol consumption with daily intake >100 g/day was associated with 85% abnormalities on ECG with 4(33.33%) showing multiple ECG abnormalities. This study did note any significant benefit with mild or moderate alcohol consumption but corroborated the effect of excessive alcohol consumption seen by electrocardiographic findings. Alcohol drinkers have longer corrected QT interval. The impact of alcohol on the heart seen by electrocardiography was dose dependent and showed progressive increase from mild to excessive alcohol consumption.

Keywords: Alcohol, ECG, Electrocardiography, Ethanol, QTC.

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I. Introduction:

On the 20th of January 2022, the World Heart federation launched a new policy brief on the Impact of Alcohol on the Cardiovascular Health Myths and Measures ^[1]. Which challenged the concept that moderate alcohol consumption was associated with a decrease in the risk of heart disease and described it as a myth. The policy therefore called for stricter measures on alcohol consumption and has blamed the remarkable rise in prevalence of cardiovascular diseases globally (almost a hundred percent in the past two decades) ^[1] partly to alcohol consumption. Nevertheless, research studies ^[2-5] have confirmed the varied view of authors with regards to moderate alcohol consumption, they however agree that excessive alcohol consumption has a deleterious effect on the cardiovascular system ^[7-10]. There is need to revisit this conflict in agreement, with the recent action of the World Heart Federation. Race and ethnicity no doubt plays a significant part in disease pattern and presentation and response to various molecules ^[11]. This series of studies seeks to evaluate and contribute to information on this very important topic. Alcohol cardioprotective nature became an issue of interest after the publishing of the “FRENCH PARADOX” this compared the prevalence of cardiovascular disease in the American population relative to the French population with relation to alcohol as a risk factor. The French population had a lower prevalence of cardiovascular amongst them and yet were heavier drinkers relative to the Americans ^[12].

The effect of alcohol on the cardiovascular system is dependent on the amount taken and duration ^[13]. Drinking of alcoholic beverages has been associated with a transient tachycardia and rise in blood pressure soon after drinking, which is said to resolve in minutes ^[13]. However, the sustained intake of alcohol has been associated with palpitations arising from arrhythmias ^[14]. Arrhythmias are the commonest complications associated with chronic alcohol consumption.

Hypertension has over the years been associated with long term alcohol intake. Alcohol intake is a known modifiable risk factor for the development of hypertension ^[15]. Alcoholic heart muscle disease also known as alcoholic cardiomyopathy has been associated with long term excessive consumption of alcohol ^[16].

Electrocardiography is a very valuable, cheap, readily available and informative tool used in the assessment of cardiac diseases. It involves the use of electrodes placed on the precordium and limbs that allow the reading of the electrical activities of the heart which when interpreted help assess, heart rhythm abnormalities, structural abnormalities, electrolyte derangements and ischaemic changes, The 12 lead ECG with a rhythm strip is the most widely utilized and can offer very detailed information ^[17].

Electrocardiographic findings depend on the stage of cardiovascular manifestation or complications developed ^[18]. However, the commonest complication associated with drinking are arrhythmias and the commonest arrhythmia in drinkers is sinus tachycardia, also, studies have reported atrial fibrillation, heart blocks.

Hypertensive complications like hypertensive heart disease and even cardiac failure can be seen as chamber hypertrophy and dilatations of the atria. Studies have corroborated this findings in drinkers ^[19-22]

Studies have confirmed the beneficial effect of alcohol consumption to the cardiovascular system; however, the debate exist on the protective elements or components of the alcohol. Some have put forth an argument for antioxidants and polyphenolic compounds; such as flavanols, monomeric and polymeric flavan-3-ols, highly coloured anthocyanins as well as phenolic acids and the stilbene polyphenol, resveratrol ^[23] rather than ethanol as the protective component in alcoholic beverages. Resveratrol prevents the prothrombotic effect of cholesterol, reduces the ability of LDL-cholesterol to undergo oxidation, which is a primer for atherosclerotic process. It also inhibits platelet aggregation.

On the other hand, Alcohol ^[24] is believed to offer protection by increasing levels of tissue plasminogen activator a is a serine protease enzyme with fibrinolytic properties. Levels of t-PA was found to be higher in drinkers when compared to non-drinkers ^[25]. Additional protection by alcohol on the heart from ischemia was by preconditioning ^[26]. These benefits were in addition, to its effect on the different types of cholesterol ^[27,28]. Alcohol was said to be associated with higher HDL level by reducing the action of CETP and also known to reduce the level of LDL-cholesterol. This study sets out to see the translation of these findings on the Electrocardiogram of alcohol consumers in Rumuekini community.

II. Method:

Study Design: It was a prospective, cross-sectional, community-based survey

Study Site: carried out in the town hall of Rumuekini, a suburban community in Rivers State, from August 2018 - September 2018,

Ethical Consideration: Ethical clearance was obtained from the Community development committee of Rumuekini community and the Royal highness of the Rumuekini Community. And consent obtained from each

study subject after detailed explanation on the procedure and purpose of study, care was taken not to judge them and confidentiality kept.

Study Population: Fifty subjects consented to be part of a study that evaluated cardiovascular disease in those who consumed alcohol. All were males as no female turned out to be part of the study. Forty-Seven (47) of the fifty had electrocardiogram. All respondents were duly counselled of the study protocol and consent obtained from each subject.

Exclusion Criteria: They had their blood sugar assessed and diabetics were excluded from the study.

Method: A questionnaire with details on biodata, occupation, symptoms, type of alcohol, from which quantity of daily alcohol consumption estimated and history of smoking noted. The questionnaire was merged with proforma for clinical findings, drug history, recordings of electrocardiographic, echocardiographic and carotid doppler findings.

This arm of the study evaluated the Electrocardiographic findings and, had the study population divided into 3 groups; based on amount of daily alcohol consumption to Mild, Moderate and Excessive. All subjects had their blood pressures measured after measuring their weight and heights and their body mass indices were estimated. Clinical examination was carried out on all subjects.

Electrocardiography: An adhoc laboratory was set-up in a room within the community hall to allow for privacy. 12 lead Electrocardiogram was performed using, CAREWELL ECG (1103) machine.

Data Analysis: was collated on excel spreadsheet and analysed using Data for the 47 subjects that had ECG was analysed for cardiac abnormalities Analysis was performed using the Statistical Package for Social Sciences version 23(SPSS 23). Continuous variables were expressed as means \pm SD (standard deviation) while categorical variables were expressed as percentages. Differences of the means between two groups were compared with Paired' t' test. Proportions or the categorical parameters was be analysed with the chi-square. A p -value of < 0.05 was considered statistically significant. In addition, comparison of the 47 electrocardiograms was made with data for 25 apparently normal for P wave interval, QRS interval and QTc interval.

III. Results:

Alcoholic beverages taken were classified into **Beers**; Star, Golder, Guinness, Heineken, Harp, Legend. **Gin** (Local gins kai-kai), **Palm Wine, Whisky**, squadron. Beer was the most common drink. The amount of alcohol was estimated for beer 50g/cl^[29], for whiskey as for liquor with a range of 20-40g/l^[29]. For local gin[40g/l]^[29]. Palm-wine was more difficult to estimate as the amount of alcohol varied with duration of stay after tapping.

The study population was divided into three groups based on the amount pf alcohol consumed daily, Mild Alcohol consumption was defined as \leq 50g/day, Moderate: 51-100g/day and excessive alcohol consumption: > 100g/day. The range for total alcohol consumed was 15 to 190g/dl.

Forty-seven (47)of the fifty(50) men that consented to be part of the studies had electrocardiography test, with age range from 19yrs to 91yrs and mean \pm SD of 34.49 \pm 17.25yrs. mean \pm SD systolic blood pressure of 128.10 \pm 21.92mmHg and mean \pm SD diastolic blood pressure of 77.20 \pm 14.87mmHg, mean \pm SD daily value of alcohol consumed was 74.24 \pm 43.34g/day, Eighteen (40.42%) Students accounted for majority of the study population, followed closely by traders (22%) there was only one driver and one applicant. (See table 2). Sixteen (39%) were smokers

Fifteen (30%) of the total study population of fifty (50) were asymptomatic. In the study population the most common symptom, was chest pain occurring in 18(36%) followed closely by palpitations in 11(22%), with dyspnoea in 5(10%) and pedal swelling in 3. Three were in congestive cardiac failure by Framingham's criteria^[30] of heart failure with displaced apex beats, raised jugular venous pulsation and heart murmurs.

The most common electrocardiographic abnormalities were arrhythmias; sinus tachycardia, sinus bradycardia, heart blocks, conduction delay. Other abnormalities noted were left ventricular hypertrophy (LVH). Left axis deviation, right ventricular hypertrophy (RVH,) left and right atrial enlargement.

Fifty percent (50%) of those considered by the study to consume \leq 50g/day of alcohol(mild)showed abnormalities in their ECGs which were majorly arrhythmias. Also, fifty percent (50%) of those considered by the study to be moderate drinkers with daily intake of 50-100g/day had abnormal ECG with 3(13.64%) and Excessive alcohol consumption with daily intake >100g/day was associated with 85% abnormalities on ECG with 4(33.33%) showing multiple ECG abnormalities.

Comparison of P -wave duration, ORS duration and QTc interval of drinkers and non-drinkers showed a significant difference in QTc interval; drinkers had relatively longer QTc interval when compared to normal.

Hypertension defined as systolic blood pressure ≥ 140 mmHg and diastolic blood pressure ≥ 80 mmHg^[31] diastolic was noted in 10 (20%) of the study population. Two of the hypertensives in this study fell into the mild drinker's group, five (5) were in the moderate drinkers' group while three (3) were from the excessive drinkers group. Electrocardiographic findings of LVH were seen in the two from the mild category one of the moderate drinkers showed multiple ECG abnormalities.

IV. Discussion

Rumuekini^[32] is a suburban town in Obio/Akpor local government area of Rivers State, Nigeria. The proximity of this town to Choba, which is popular for the University situated in it, the University of Port Harcourt, makes it a residential hub for students. Hostel accommodations are not readily available due to the population of student attending the school. This explains for the large student percentage (43%) of the study population. Only one applicant in our study population also points to the fact that drinking is an expensive social habit, requiring a steady income to fuel it. The small study population can be attributed to the social stigma attributed to alcohol consumption and this is the reason why females refused to be a part of the study population.

The age range was very wide despite the small study population The study recruited age as young as 19yrs and as old as 97yrs. In addition, the study identified smokers and non-smokers amongst the study population; smokers made up 39% of the study population. It is a notable fact that both social habits go hand in hand. About sixty-eight percent (68.3%) of the study population were single. This correlated with the number of students and could imply that the married were less likely to drink. This was also the report from some social platforms and studies^[33,34]

Most drinkers admitted to taking beer, some Gin especially local gin whilst some admitted to whiskey. Two in this group admitted to taking wine, five were not specific and said all brands. For those it was difficult to quantify the amount of alcohol consumed and they were classified as excessive drinkers.

The mean \pm SD age for the study population (32.85 \pm 15.61yrs.) showed younger drinkers dominated the study population. Young drinkers also accounted for majority of the excessive drinker's group with mean age \pm SD (31.46 \pm 11.48yrs). The mean \pm SD daily amount of alcohol for the study population was 75.16 \pm 48.69g/day, with mean \pm SD values for the mild consumers as 15.00 \pm 0.00g/day and for the excessive daily consumers of alcohol as high as 140. 91 \pm 29.48g/day.

The mean BMI was 24.00 \pm 3.11kg/m² and was highest in the excessive alcohol consumption group with a mean of 25.03 \pm 2.25kg/m² (overweight). Excessive alcohol consumption has been linked with obesity.

The mean \pm SD systolic BP, 132.52 \pm 25.33mmHg and mean \pm SD diastolic blood pressure 78.81 \pm 18.15mmHg were however higher in the moderate class of drinkers with daily consumption of 51-100g./day of alcohol. This may be accounted for by the population and mean age of the group.

Alcohol consumption did not translate to any level of protection in the population studied as only 30% were asymptomatic. Seventy percent had symptoms with chest pain being the commonest symptom followed closely by palpitation. Smoking in this population may explain the increased prevalence of chest pain in this study population a study which excludes smokers will better guide this information, however only four had dyspnoea which may lower the chances of attributing the chest pain to a respiratory cause. Palpitation was a very common symptom amongst the study populace, seen in 11(22%) subjects. Three of the subjects were in congestive heart failure with dyspnoea, pedal swelling, raised jugular venous pulsation displaced apex beat and abnormal heart sounds to include heart murmurs.

Electrocardiographic findings corroborated the clinical findings with normal ECG in only 40.4% of the total patients who had ECG done out of which multiple ECG abnormalities was seen in 8(14.89%). These findings fail to show the benefit attributed to ethanol, it may not be conclusive because of the study size and it did not evaluate the role of antioxidants from wine as most of the study subjects took beer and gin rather than wine However, it did not show any added benefit of alcohol lowering effect on LDL-cholesterol and increase on HDL seen on the Cholesterol arm of this study³⁵.

V. Conclusion:

Fifty percent (50%) of those considered by the study to consume ≤ 50 g/day of alcohol(mild)showed abnormalities in their ECGs which were majorly arrhythmias. Also, fifty percent (50%) of those considered by the study to be moderate drinkers with daily intake of 50-100g/day had abnormal ECG with 3(13.64%) and Excessive alcohol consumption with daily intake >100 g/day was associated with 85% abnormalities on ECG with 4(33.33%) showing multiple ECG abnormalities. These findings fail to show the benefit attributed to ethanol, it may not be conclusive because of the study size and it did not evaluate the role of antioxidants from wine as most of the study subjects took beer and gin rather than wine However, it did not show any added benefit of alcohol lowering effect on LDL-cholesterol and increase on HDL seen on the Cholesterol arm of this study population³⁰.In addition, Alcohol drinkers have longer corrected QT interval. The impact of alcohol on the

heart seen by electrocardiography was dose dependent and showed progressive disease from mild to excessive alcohol consumption

TABLE 1: COMPARISONS BETWEEN GROUPS

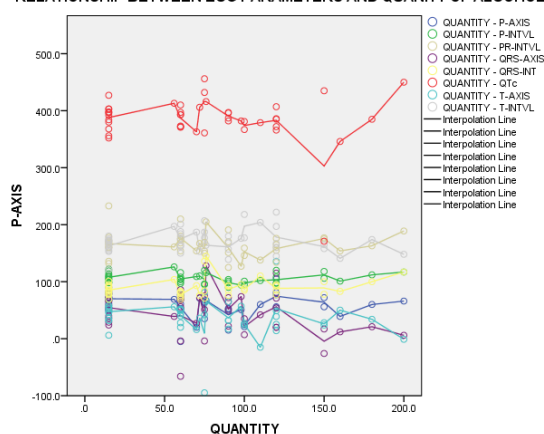
CARDIOVASCULAR PARAMETERS	TOTAL N=47	MILD ALCOHOL N=12	MODERATE ALCOHOL N=22	EXCESSIVE ALCOHOL N = 13
QUANTITY of Alcohol (g/day)	75.16 ± 48.69	15.00 ± 0.00	75.09 ± 14.88	140.91 ± 29.48
AGE(yrs)	32.85 ± 15.61	27.92 ± 9.42	36.36 ± 19.58	31.46 ± 11.48
BMI(kg/m ²)	24.00 ± 3.11	23.62 ± 2.86	23.60 ± 3.61	25.03 ± 2.25
SBP(mmHg)	129.33 ± 20.01	124.67 ± 12.41	132.52 ± 25.33	128.46 ± 15.88
DBP (mmHg)	77.30 ± 14.50	76.27 ± 9.82	78.81 ± 18.15	75.58 ± 11.24
ECG Findings				
QTc		388.00 ± 21.39	392.76 ± 23.73	375.15 ± 67.17
Normal ECG	19(40.4%)	16 (50%)	11(50%)	2(15.4%)
Rhythm Abnormalities	11	3	6	2
Premature Atrial Complex	3		2	1
Premature Ventricular Complex	1		1	
Type 1 AV Block	2	1	1	
Sinus bradycardia	2		1	1
Sinus Tachycardia	2			
Sinus Arrhythmia	2		1	1
Interventricular Conduction Delay	1		1	
Left Axis Deviation	3		2	1
Left Atrial Enlargement	4	1		3
Left Ventricular Hypertrophy	8	2	2	4
Right Axis Deviation	1			1
Right Atrial Enlargement	1	1		1
Right Ventricular Hypertrophy	2		1	1
Pathologic Q wave	1	1		
Multiple ECG abnormalities	7	1	3	3

BMI: Body mass index, SBP: systolic blood pressure, DBP: diastolic blood pressure. BMI: Body mass index, SBP: systolic blood pressure, DBP: diastolic blood pressure.

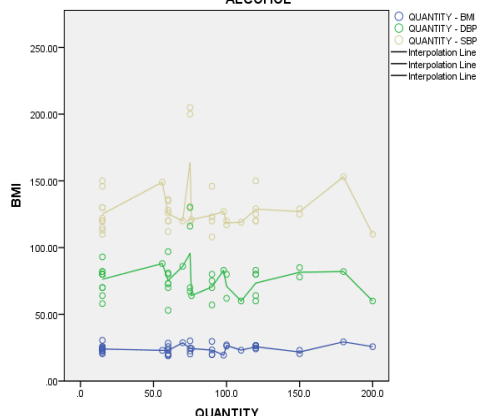
TABLE 2 COMPARISON OF ECG PARAMETERS BETWEEN NORMAL AND DRINKERS

ECG PARAMETERS	Mean± SD Normal(25)	Mean± SD Drinkers(47)	Std. Error Mean	t	Sig(2 Tailed)
P-Wave Duration(ms)	106.65± 24.39	108 ± 7.91	5.03	-.30	.77
QRS – Duration (ms)	89.27 ± 22.70	83.33 ± 9.18	4.54	1.30	.20
QTc (ms)	404.75 ± 24.94	390.67 ± 20.68	6.08	2.32	.03

RELATIONSHIP BETWEEN ECG PARAMETERS AND QUANTITY OF ALCOHOL



RELATIONSHIP BETWEEN BLOOD PRESSURE AND BMI AND QUANTITY OF ALCOHOL



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