The Impact of Alcohol on The Carotid Parameters: In Rumosi Residents

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ABSTRACT:

Background

Alcohol consumption is a recognized risk factor for cardiovascular diseases, including hypertension. However, its specific effects on carotid vessels have not been extensively studied. Understanding these effects is crucial for gaining insights into the pathogenesis of cardiovascular diseases, particularly in regions with high alcohol consumption like Nigeria.

Methods

A cross-sectional study, conducted in Rumuekini, Nigeria, involving forty-seven male (mean age 34.49 ± 17.25 years). Participants were categorized into mild, moderate, and excessive drinkers of alcohol. Data on blood pressures, body mass index, and carotid artery parameters were collected. Statistical analysis was performed to compare these parameters between alcohol consumers and data from control group of non-consumers.

Results

The mean SBP and DBP for alcohol consumers were 128.10 ± 21.92 mmHg and 77.20 ± 14.87 mmHg. The average daily alcohol consumption was 74.24 ± 43.34 g/day. BMI was significantly lower in alcohol consumers (23.46 ± 2.82 kg/m²) compared to non-consumers (p=0.014). Right carotid diameter was also significantly smaller in alcohol consumers (p=0.027). The analysis indicated that even mild alcohol consumption was associated with elevated blood pressure. Additionally, BMI across all alcohol consumption levels fell within the overweight range, highlighting potential weight-related health issues.

Conclusion

Excessive Alcohol consumption, is associated with elevated blood pressures and increased cardiovascular risks. Alcohol consumers exhibit a smaller right carotid diameter, indicating potential vascular narrowing. These changes suggest that alcohol impacts blood vessels differently from non-consumers, contributing to increased risk of atherosclerosis and cardiovascular diseases, highlighting the need for targeted public health interventions.

KEYWORDS: Alcohol consumption, Cardiovascular diseases (CVDs), Hypertension, Carotid vessels, Carotid intima-media thickness (cIMT), Atherosclerosis

INTRODUCTION

Alcohol consumption is widely recognized as a significant risk factor for cardiovascular diseases, including hypertension. However, the specific effects of alcohol on blood vessels have not been extensively evaluated. Understanding the effect of alcohol on the carotid vessels is particularly informative and can provide valuable insights into the etio-pathogenesis of cardiovascular diseases.

Evidence from the 2016 Global Burden of Diseases[1] indicated that Nigeria had one of the highest prevalence rates of current alcohol use among adults aged 15 years and older in sub-Saharan Africa, with 40 to 59.9% of her population consuming alcohol. In 2016, alcohol consumption was notably high in high socio-demographic index (SDI) countries, with a prevalence of 83% among males and 72% among females. In contrast, alcohol consumption among females was 8.9% and among males was 20% in low and middle-income

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countries (LMICs)[1-3]. In 2019, approximately 2.4 million deaths were attributed to alcohol consumption, accounting for 4.3% of all deaths globally. [4]

The "STRATEGY" study: "*Stabilization of Plaques Using Darapladib-Thrombolysis in Myocardial Infarction Evaluation of Acute Coronary Syndrome*. is one study that observed a significant relationship between alcohol consumption and increased carotid intima-media thickness (cIMT) in healthy men aged 30-70: those consuming more than 20 grams of alcohol daily had noticeably higher cIMT than those consuming less. This association persisted even after adjusting for other cardiovascular risk factors and lifestyle variables. Interestingly, no significant link was found for women, and the type of alcoholic beverage didn't influence the results.[5]

An age-adjusted relationship between alcohol consumption and carotid artery disease has been described as U-shaped, with light drinkers exhibiting a lower risk of atherosclerosis compared to abstainers or heavy drinkers. This finding suggests that moderate alcohol consumption may have a protective effect on cardiovascular health, while excessive consumption poses significant risks.[6]

The study by Zureik et al. found a cross-sectional association between current alcohol intake and carotid atherosclerosis in non-white men, non-white women, and white men, but not in white women[7]

There have been fewer studies assessing the relationship between alcohol and vessel diameter. However, a recent publication attempted to review these studies, highlighting the need for further research in this area. Alcohol has been shown to affect vessel distensibility and cause stiffness, which could have implications for cardiovascular health.[8]

Cardiovascular diseases (CVDs) are primarily caused by atherosclerosis, a process where plaques build up in the arterial walls, leading to narrowed and hardened arteries. This pathogenesis involves endothelial dysfunction, where the inner lining of blood vessels fails to regulate vascular tone and maintain a non-inflammatory state[9]. Factors like oxidative stress, inflammation, and genetic predispositions contribute to this dysfunction. As a result, the endothelium shifts from an anticoagulant and vasodilatory state to a prothrombotic and vasoconstrictive state, promoting plaque formation and arterial stiffness.

In the carotid arteries, these changes are reflected as plaques and intimal thickening, which can be detected through carotid Doppler ultrasound. The Doppler findings include increased peak systolic velocity (PSV) and end-diastolic velocity (EDV) in the presence of significant stenosis[10]. The ICA/CCA PSV ratio is used to quantify the degree of stenosis, with higher ratios indicating more severe narrowing. These ultrasound assessments are crucial for early detection and management of CVDs, guiding preventive measures and informing public health strategies to reduce the burden of these diseases[11].

METHODOLOGY
Study Objectives
The primary objective of this study is to evaluate the effects of alcohol consumption on the common carotid artery intima-media thickness (cIMT) and the diameters of the right common carotid and left common carotid arteries (RCC and LCC). By examining these parameters, the study aims to provide a better understanding of the vascular effects of alcohol. The study also investigates the differences in various health parameters between alcoholic and normal populations, with specific focus on age, BMI, blood pressure, and carotid artery measurements.

Study Design
This was a prospective, cross-sectional, community-based study conducted in Rumuekini, a suburban community in Rivers State. An Ad-hoc lab, was created in the town hall of Rumuekini, a suburban community in Rivers State, after consultation and ethical approval was obtained from the Community Development Chairman (CDC) of Rumuekini and the Royal highness of the Rumuekini Community. Consenting subjects from the Rumuekini community had carotid doppler using a Philip ATL ultrasound machine and a linear probe of 7-15mHz frequency, after filling a questionnaire with information on biodata, symptoms and history of alcohol consumption. All respondents were duly counselled on the study protocol and care was taken not to judge them and confidentiality kept. They had their blood sugar assessed and diabetics were excluded from the study.

Study Population
Consenting, non-diabetic individuals who admitted to a history of Alcohol consumption from the Rumuekini community participated in the study. Had carotid doppler studies and values obtained was compared with set of normal carotid artery variables, after matching for cardiovascular parameters.

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Sample Size:[12]
A sample size of 30 was used in this study, due to social stigmata associated with alcohol consumption. The sample size of 30 often considered a minimum threshold for reliable data in statistical analysis due to the Central Limit Theorem (CLT). The CLT states that, regardless of the underlying population distribution, the distribution of the sample means will approach a normal distribution as the sample size gets larger, typically around 30 or more.

Data Collection
40 participants completed a detailed questionnaire administer by trained medical personnel covering biodata, occupation, type and quantity of daily alcohol consumption, and smoking history. They were also clinically evaluated, with symptoms and signs recorded. The values of the alcohol consuming population was compared with 20 normal variables after matching for cardiovascular parameters

Carotid Doppler Ultrasound
A Philips ATL machine with a linear probe was used to perform carotid Doppler ultrasound in an ad-hoc lab set up in the community hall. Two extracranial vessels, the left and right common carotid arteries (LCC and RCC), were evaluated using a predefined protocol. Measurements included vessel diameter and intima-media thickness. These values were compared against age-matched normal variables.

Scanning Procedure
The examination began proximally in the transverse plane, and was followed distally to the bifurcation. This was repeated in the longitudinal plane to track the course and measure intimal thickness as well as velocity of flow. Color flow Doppler was then utilized to aid in assessing patency and flow direction.

The diameter of the common carotid vessels was measured at the mid-vessel, two values for vessel diameter and intima-media thickness (IMT) were obtained and averaged for analysis.

Definition of Abnormalities: [13]

Normal cIMT: IMT: 0.07± 0.02cm for both common carotid arteries.

Normal Diameter of Arteries: mean diameters 0.68±0.08cm and 0.68±0.11cm on the left and right respectively.

Data Analysis
Data from the questionnaires and clinical evaluations were collated using an Excel spreadsheet. The Statistical Package for Social Sciences (SPSS) version 23 was employed for data analysis, allowing for statistical comparison and interpretation of results.

RESULTS
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 carotid examination, with age range from 19yrs to 91yrs and mean ± SD of 34.49 ± 17.25yrs. mean ± SD systolic blood pressure of 128.10 ± 21.92mmHg and mean ± SD diastolic blood pressure of 77.20 ± 14.87mmHg, mean± SD daily value of alcohol consumed was 74.24 ± 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.

For the index study where the majority of the study population consumed alcohol above 15g /day *However for the purpose of the particular study, they were further categorized: into Mild, Moderate and Excessive Drinkers: with the mild consumers as 33.90 ± 13.17g/day, 76.58 ± 16.65/day for moderate drinkers and for the excessive; daily consumers of alcohol as high as 142. 56 ± 0.23g/day.*

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[13] of heart failure with displaced apex beats, raised jugular venous pulsation and heart murmurs.

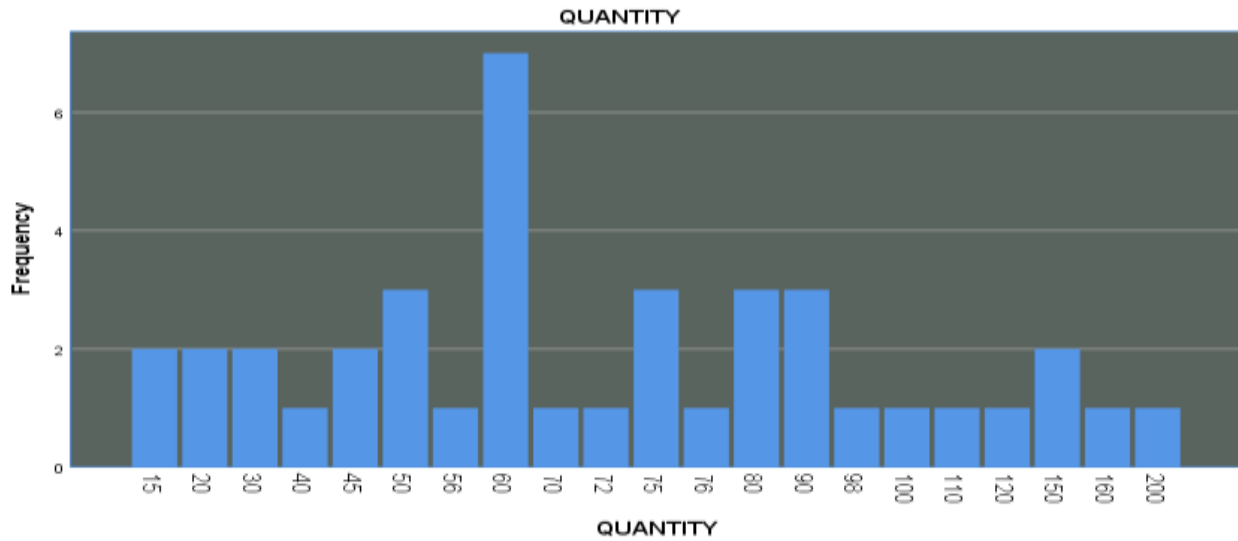**The Impact of Alcohol on The Carotid Parameters: In Rumosi Residents**

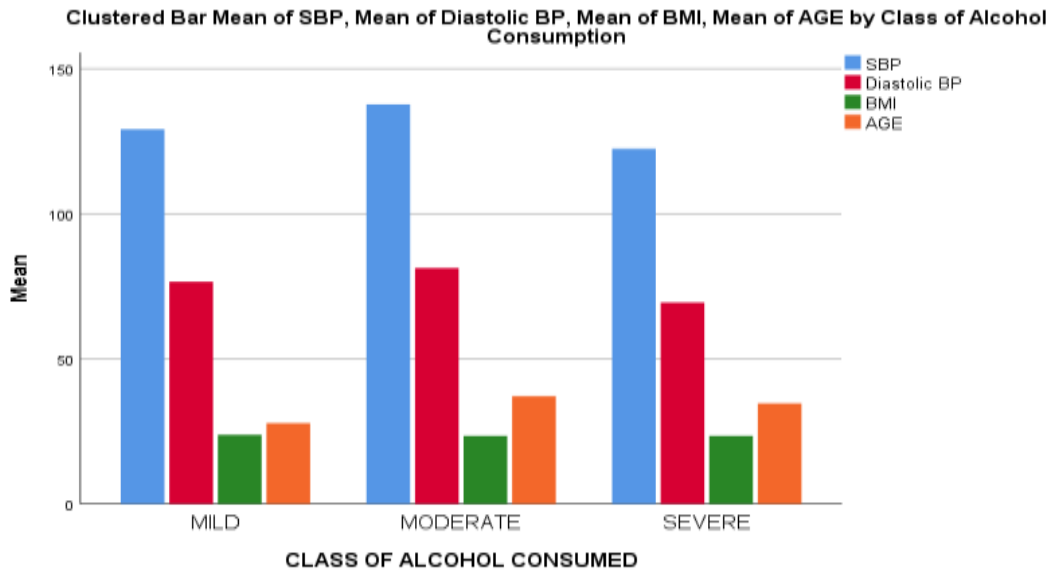**Figure 1: Quantity of alcohol Consumed**

Figure 2 :Relationship Between Alcohol Consumption/ Cardiovascular parameters

Table 1: Carotid Artery and Cardiovascular Parameters in alcohol Consumers

PARAMETERS	MEAN± SD
ALCOHOL QUANTITY	69.56 ± 42.21g
AGE	33.10 ± 16.17
BMI	23.46 ± 2.82
SBP	131.64 ± 21.77
Diastolic BP	77.89 ± 15.57
CIMT RT	0.132 ± 0.097cm
RT DIAM	0.620 ± 0.142
CIMT LT	0.123 ± 0.062
LT DIAM0	0.659 ± 0.138

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Table 2: Comparisons of Means for Groups

CARDIOVASCULAR PARAMETERS	Mild Alcohol Consumers n=15	Moderate Alcohol Consumers n=18	Excessive Alcohol Consumers n= 8
AGE(yrs)	31.00 ± 14.20	40.58 ± 21.56	31.13 ± 12.38
BMI9kg/m^2)	23.97 ± 4.15	23.89 ± 3,69	24.97 ± 2.64
SBP(mmHg)	124.40 ± 18.91	132.00 ±27.24	126.25 ± 12.48
DBP(mmHg)	75.00 ± 9.55	80.67 ± 19.20	73.50 ± 11.36
PR(beats/min	73.60 ± 7.73	73.24 ± 10.65	74.37 ± 11.36
QUANTITY(g/day)	33.90 ± 13.17	76.58 ± 16.65	142. 56 ± 0.23

Table 3: Comparism Of Carotid Parameters Between Normal and Alcohol Consumers

PARAMETERS	MEAN ± SD	T	df	Sig. (2-tailed)
AGE ALCOHOL – AGE(yrs)	-11.97 ± 6.72	-6.23	32	.40
BMI ALCOHOL – BMI(kg/m^2)	-2.15 ± 4.77	-2.59	32	.014
SBP ALCOHOL - SYSTOLIC BP (mmHg)	3.97 ± 19.12	1.11	28	.274
DBP ALCOHOL - DIASTOLIC BP(mmHg)	1.78 ± 15.47	.597	26	.556
CIMT RT ALCOHOL - RCC/IMT (cm)	-.0041 ± .17	-.092	14	.928
RT DIAM ALCOHOL - RCC/DIAM (cm)	-.094 ± .15	-2.44	15	.027
CIMT LCC - LCC/IMT (cm)	-.017 ± .21	-.384	23	.704
LT DIAM ALCOHOL - LCC/DIAM (cm)	.027 ± .21	.730	31	.471

DISCUSSION

Rumuekini [14] 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 [16,17]

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

From the Clustered Bar Chart (fig 2):

1. Systolic Blood Pressure (SBP):

Most of the population of Alcohol consumers were largely consumers of over 50g of alcohol. For the purpose of the study they were divided into mild, moderate and severe alcohol consumers. For all levels of alcohol consumption (mild, moderate, severe), the mean SBP appears to be above 140 mmHg, indicating hypertension.

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This suggests that even mild alcohol consumption could be associated with elevated systolic blood pressure, increasing the risk of hypertension and cardiovascular diseases.

2. Diastolic Blood Pressure (DBP):
In addition, The mean Diastolic BP for each class of alcohol consumption (for this study) is also elevated, suggesting that levels of alcohol consumption(> 15g/day) are associated with higher diastolic blood pressure. Elevated diastolic blood pressure can contribute to increased cardiovascular strain and risk.

3. BMI (Body Mass Index):
  The mean BMI values across all levels of alcohol consumption seem to fall within the overweight range (25-29.9kg/m^2). This indicates that alcohol consumption may be associated with higher BMI, potentially contributing to overweight and obesity-related health issues.
Increased Cardiovascular Risk: With both SBP and DBP being above normal values for all classes of alcohol consumption, there is a clear indication of increased cardiovascular risk among alcohol consumers. Elevated blood pressure is a significant risk factor for conditions such as stroke, heart attack, and heart failure.

Furthermore, Weight Management Concerns: The mean BMI falling within the overweight range across all consumption levels suggests a correlation between alcohol consumption and higher BMI. This could lead to weight-related health issues, including metabolic syndrome and type 2 diabetes.
Consistency Across Consumption Levels: The fact that alcohol consumption in the index study shows elevated blood pressure and BMI underscores the potential health risks associated with any level of alcohol consumption and cast doubts on the health benefits of lower alcohol consumption. Public health interventions may need to emphasize the importance of monitoring and managing alcohol intake to mitigate these risks.
The clustered bar chart visually underscores the negative impact of alcohol consumption on cardiovascular health parameters, specifically highlighting elevated systolic and diastolic blood pressures and higher BMI among alcohol consumers. These observations are crucial for guiding public health strategies aimed at reducing alcohol-related health risks and promoting better cardiovascular health.

Comparison between Alcohol Consumers and Non-Alcohol Consumers:
Age
The results indicate that alcohol consumers are generally younger compared to the normal population, with a mean age difference of -11.97 years (± 6.72). Although the t-value of -6.23 and the degrees of freedom (df) of 32 suggest a noticeable difference, the p-value (Sig. 2-tailed) of .40 indicates that this difference is not statistically significant.

Body Mass Index (BMI)
The mean BMI for alcohol consumers is lower compared to the normal population, with a difference of -2.15 kg/m² (± 4.77). This result is statistically significant, with a t-value of -2.59, df of 32, and a p-value of .014. The lower BMI in alcohol consumers suggests a potential impact of alcohol consumption on body weight, although the clinical implications require further investigation.

Systolic Blood Pressure (SBP)
The comparison of systolic blood pressure between alcohol consumers and the normal population shows a mean difference of 3.97 mmHg (± 19.12). Despite a positive t-value of 1.11 and df of 28, the p-value of .274 indicates that this difference is not statistically significant. This suggests that alcohol consumption may not have a substantial impact on systolic blood pressure in the sampled population.

Diastolic Blood Pressure (DBP)
The mean diastolic blood pressure among alcohol consumers is slightly higher, with a difference of 1.78 mmHg (± 15.47). The t-value of .597, df of 26, and p-value of .556 indicate that this difference is not statistically significant, suggesting that diastolic blood pressure may not be significantly affected by alcohol consumption in this study.

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CAROTID cIMT: The mean values of cIMT for both right and left carotid arteries were relatively higher in the alcohol group when compared to the normal population, however significantly smaller vessel diameter was noted on the right carotid vessels of the alcohol group against that of the normal population.

Forty-seven percent (47.5%) had greater than 0.09cm cIMT on the left and 42.5% on the right.

Right Carotid Intima-Media Thickness (CIMT RT)

The mean right carotid intima-media thickness difference between alcohol consumers and the normal population is -0.0041 cm (± 0.17). The t-value of -0.092, df of 14, and p-value of .928 indicate that this difference is not statistically significant, suggesting no substantial impact of alcohol consumption on right carotid intima-media thickness.

Left Carotid Intima-Media Thickness (CIMT LCC)

The mean difference in left carotid intima-media thickness is -0.017 cm (± 0.21), with a t-value of -0.384, df of 23, and p-value of .704. This indicates no statistically significant difference between alcohol consumers and the normal population, suggesting that alcohol consumption may not affect left carotid intima-media thickness significantly.

CAROTID ARTERY DIAMETER: The combined carotid diameter for alcoholics (0.64192) is smaller compared to the normal population (0.71231). This consistent pattern supports the observation that chronic alcohol consumption may be associated with changes in arterial diameter, potentially increasing the risk of cardiovascular diseases.

A statistically significant difference is observed in the right carotid diameter, with a mean difference of -0.094 cm (± 0.15). The t-value of -2.44, df of 15, and p-value of .027 suggest that alcohol consumers have a smaller right carotid diameter compared to the normal population, potentially indicating an effect of alcohol consumption on arterial diameter. Suggesting a potential narrowing or reduced arterial elasticity in the alcoholic population, which could be a result of chronic alcohol consumption affecting vascular health.

Left Carotid Diameter (LT DIAM)

The mean left carotid diameter is slightly larger in alcohol consumers, with a difference of 0.027 cm (± 0.21). The t-value of 0.730, df of 31, and p-value of .471 indicate that this difference is not statistically significant, suggesting minimal impact of alcohol consumption on left carotid diameter.

The analysis highlights significant differences in BMI and right carotid diameter between alcohol consumers and the normal population, suggesting potential impacts of alcohol consumption on body weight and arterial diameter. Other parameters, such as systolic and diastolic blood pressures and carotid intima-media thickness, show no statistically significant differences. These findings underscore the need for further research to fully understand the implications of alcohol consumption on cardiovascular health.ht). Excessive alcohol consumption has been linked with obesity.

The findings highlight that alcohol consumption may contribute to changes in carotid diameter, with the alcoholic population exhibiting narrower carotid arteries compared to the normal population. These changes could have significant implications for cardiovascular health, necessitating further research and targeted public health interventions to address the impact of alcohol on vascular health. The findings indicate that alcohol consumption may be associated with changes in carotid diameter, with the alcoholic population exhibiting narrower carotid arteries compared to the normal population. This narrowing could indicate reduced arterial elasticity or early signs of atherosclerosis. The differences in carotid dimensions underscore the potential impact of chronic alcohol consumption on vascular health.

The findings are compareble with the Bruneck Study,[18] which examined alcohol consumption and carotid atherosclerosis. The effects of alcohol consumption on health are multifaceted and controversial. The Bruneck Study, have indicated dose-dependent effects of alcohol on vascular health. And found dose-dependent atherogenic and antiatherogenic effects of alcohol consumption. The Bruneck Study indicated that moderate alcohol intake might have protective cardiovascular effects, while excessive consumption is detrimental.

Our findings suggest that while alcohol consumption does not significantly impact blood pressure or carotid intima-media thickness, it may influence BMI and carotid artery dimensions. The smaller right carotid diameter observed in the alcoholic group could be indicative of specific vascular impacts of alcohol consumption, warranting further investigation into the mechanisms underlying these effects.

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Vascular stiffness is an emerging risk factor for cardiovascular events. It is believed to be a degenerative process affecting the extracellular matrix of elastic arteries

CONCLUSION

This study highlights the potential impact of alcohol consumption on carotid intima-media thickness and diameter among the male population of Rumuekini. The observed narrowing of carotid arteries in alcohol consumers underscores the need for targeted public health interventions to address the cardiovascular risks associated with alcohol consumption. Further research is essential to explore the long-term effects and to develop strategies for prevention and management.

Authors' contribution: all authors contributed significantly to the entire study processes: the corresponding author contributed to; conceptualization, planning, data collection, interpretation of the result, manuscript preparation, proofreading, and approval of the final manuscript. whilst the second author was involved in interpretation of the result, manuscript preparation, proofreading, and approval of the final manuscript.

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