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# Alcohol consumption among persons living with hypertension: evidence from a population-based study in Cape Verde

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## Abstract

**Background** Despite the well-documented effects of alcohol consumption on hypertension risk, there are persons living with hypertension who consume alcohol and may be at risk of alcohol use disorder (AUD). This paradox poses a critical public health concern and underscores a need to understand the alcohol consumption behavior of persons living with hypertension. This study investigates the prevalence and factors associated with alcohol consumption and AUD among persons living with hypertension in Cape Verde.

**Methods** Using the 2020 WHO STEPS survey, we analyzed the observations of 1,136 adults in Cape Verde. Cross-tabulations, bivariable and multivariable logistic regression were performed in STATA version 18. The results from the multivariable logistic regression model were reported in their adjusted odds ratio (AOR) and corresponding 95% confidence interval (CI).

**Results** Overall, 784 (69.1%) of the total sample reported consuming alcohol. The study revealed that 22.8% of those who consumed alcohol experienced AUD. Specifically, alcohol dependence symptoms were prevalent in 13.7% of participants who consumed alcohol in the last 12 months. Social/family problem and functional impairments were prevalent in 11.6% and 8.2%, respectively. Women were significantly less likely to consume alcohol [AOR=0.17; 95% CI: 0.12–0.25] and experience AUD [AOR=0.32; 95%CI: 0.20–0.51] compared to men. Additionally, individuals who consumed processed foods high in salt had more than twice the odds of consuming alcohol [AOR=2.34; 95% CI: 1.62–3.39]. Urban residents [AOR=1.76; 95% CI: 1.33–2.31] and current smokers [AOR=2.23; 95% CI: 1.13–4.38] were more likely to consume alcohol. Individuals with higher education [AOR=4.34; 95% CI: 1.97–9.55] were more likely to consume alcohol but less likely to experience AUD [AOR=0.09, 95%CI: 0.02–1.87].

**Conclusion** The high prevalence of alcohol consumption and AUD among persons living with hypertension in Cape Verde signals a critical need for targeted public health strategies. Interventions should prioritize men, urban residents, current smokers, and individuals with higher education, given their higher likelihood of alcohol consumption. Additionally, given the lower likelihood of AUD among highly educated individuals, yet their higher alcohol consumption rates, interventions should balance education on the risks of excessive alcohol use while promoting responsible drinking.

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**Keywords** Hypertension, Alcohol, Public health, Non-communicable diseases

## Background

Hypertension, the silent killer, remains an important global public health concern [1]. The World Health Organization (WHO) estimates that about 1.28 billion people are living with hypertension; of this number 46% are unaware of their status while only one-fifth (21%) of adults have their condition under control [2]. While the global age-standardized prevalence of hypertension has flattened, it continues to increase in low-and-middle-income countries (LMICs) [3–5]. Zhou et al. [3] report that in places like sub-Saharan Africa (SSA), hypertension is prevalent in 48% of women and 34% of men. In Cape Verde, an estimated hypertension prevalence of 25% has been reported [6]. Addressing the burden of hypertension in Cape Verde requires preventive measures to control risk factors.

Previous studies [7–11] have identified socio-demographic and lifestyle risk factors for hypertension. Among the established risk factors of hypertension include diets high in salt, sugar, and fat but low in fruits and vegetables, along with sedentary lifestyles, smoking, and obesity [7, 8]. Additionally, various sociodemographic factors such as sex, wealth index, type of cooking fuel, and increasing age have been found to significantly predict the risk of hypertension [9–11].

Beyond these factors, alcohol consumption has been linked to a higher risk of hypertension [2]. For instance, Phillips et al. [12] found that each additional drink of alcohol significantly exacerbated the risk of higher systolic and diastolic blood pressure. Another study [13] conducted in the United States has shown that individuals who consume alcohol have a 57% higher risk of developing hypertension. Roerecke et al. [14] have also indicated that reducing alcohol consumption significantly reduces hypertension risk, particularly among those who used to consume two or more drinks.

Despite the well-documented effects of alcohol consumption on hypertension risk, there are persons living with hypertension who consume alcohol and may be at risk of alcohol use disorders (AUD). This paradox poses a critical public health concern and underscores a need to understand the alcohol consumption behavior of persons living with hypertension. A critical review of extant literature in different contexts [3–14] shows that there are currently no published studies that bring to fore the factors that predict alcohol consumption among persons living with hypertension. As such the following questions remain: (a) How prevalent is alcohol consumption and alcohol use disorder among persons living with hypertension? (b) What factors are associated with alcohol consumption and alcohol use disorder among persons living

with hypertension? Gaining clarity on the prevalence and predictors of alcohol consumption among persons living with hypertension is necessary to inform targeted interventions and policies aimed at reducing alcohol consumption in this high-risk population. Against this background, the present study aimed to investigate the prevalence and predictors of alcohol consumption among persons living with hypertension in Cape Verde.

## Methods

### Design and data source

This study used secondary data from the 2020 WHO STEPS survey, which assessed non-communicable disease (NCD) risk factors in Cape Verde [15]. This survey was conducted from February to March 2020 and followed a structured three-step process. Step 1 focused on collecting comprehensive socio-demographic and behavioral information [15, 16]. In Step 2, physical measurements including height, weight, and blood pressure were obtained. Step 3 involved the collection of blood and urine samples for biochemical analysis, which included assessments of blood glucose levels, cholesterol levels, and salt intake [15, 16]. The survey targeted a population-based sample of adults aged 18–69 years. To ensure representativeness of this age group within Cape Verde, a multiple-stage probability sampling design was employed. A total of 4,563 adults participated in Steps 1 and 2, while a subsample of 2,436 adults completed Step 3 [15]. In this study, we analyzed the observations of 1,136 adults.

### Measures

#### Outcome variable

**Lifetime alcohol consumption** This was one of the outcome variables. This was assessed by the question, “Have you ever consumed alcohol?” The question had a binary response of ‘yes’ and ‘no’. Responding ‘yes’ was interpreted as having consumed alcohol while ‘no’ indicated non-consumption of alcohol.

**Alcohol use disorder (AUD)** The variable was created as an index of three indicators, namely: alcohol dependence symptoms, functional impairment, and social/family problems. Alcohol dependence symptom was derived from the question that sort to know whether participants were unable to stop drinking in past 12 months and whether they needed a drink first thing in the morning in the past 12 months. Functional impairment was from the question that solicited whether participants failed to do what was expected due to drinking while family problem was from the question, ‘had family problem due to

alcohol?'. The original responses for these indicators were never, daily, weekly, monthly, and less than monthly. We dichotomized the responses as never = no AUD and other responses as 'yes'.

### Explanatory variables

Six factors were selected as explanatory variables. These included sex, age, marital status, educational level, place of residence, current smoking status, overweight/obesity status (derived from body mass index), and consumption of processed food high in salt. The selection of these variables was informed by a plethora of studies [17–20] that had identified such factors to be associated with alcohol consumption.

**Table 1** Sample distribution and prevalence of alcohol consumption among persons living with hypertension

Variables	Weighted sample n (%)	Proportion consumed alcohol n (% [95%CI])	p-values
<b>Sex</b>			<b>&lt;0.001</b>
Men	459 (40.4)	406 (88.4 [83.7–91.9])	
Women	677 (59.6)	379 (56.0 [50.8–61.0])	
<b>Age</b>			0.053
18–29 years	146 (12.9)	111 (76.1 [63.2–85.5])	
30–39 years	181 (15.9)	138 (76.2 [66.7–83.7])	
40–49 years	266 (23.4)	192 (72.0 [63.1–79.4])	
50 years and older	542 (47.7)	344 (63.4 [58.0–68.5])	
<b>Educational level</b>			<b>&lt;0.001</b>
No formal education	101 (8.9)	49 (48.7 [38.7–58.8])	
Primary/basic	576 (50.7)	376 (65.2 [59.7–70.4])	
Secondary/middle	348 (30.6)	264 (75.9 [68.4–82.1])	
Tertiary	111 (9.8)	96 (86.3 [73.8–93.3])	
<b>Residence</b>			<b>&lt;0.001</b>
Rural	428 (37.7)	251 (58.7 [51.8–65.2])	
Urban	708 (62.3)	534 (75.4 [70.7–79.5])	
<b>Marital status</b>			<b>0.091</b>
Never married	425 (37.4)	286 (67.4 [60.6–73.6])	
Married	273 (24.0)	187 (68.3 [60.5–75.2])	
Previously married	147 (12.9)	90 (61.3 [52.1–69.8])	
Cohabiting	291 (25.6)	221 (76.1 [68.4–82.5])	
<b>Currently smokes</b>			<b>0.004</b>
No	1055 (92.9)	715 (67.7 [63.6–71.6])	
Yes	81 (7.1)	70 (86.8 [75.0–93.5])	
<b>Consumes processed food high in salt</b>			<b>0.013</b>
No	153 (13.5)	88 (57.4 [46.8–67.3])	
Yes	983 (86.5)	697 (70.9 [66.8–74.7])	
<b>Overweight/obese</b>			0.319
No	423 (37.2)	303 (71.5 [65.1–77.2])	
Yes	713 (62.8)	482 (67.6 [62.7–72.2])	
Total	<b>1136 (100.0)</b>	<b>784 (69.1)</b>	

### Statistical analysis

Prior to the actual data analysis, we ensured that there were no missing values for the outcome and explanatory variables by conducting a thorough data cleaning process. This involved checking for missing values using descriptive statistics and frequency distributions, followed by listwise deletion of any cases with missing values. This process of excluding missing values resulted in a final sample size of 1,136. We based all of our analyses on the observations of 1,136 adults. It must be noted that the WHO STEPS data has different weights for the interviews, physical measurements, and biochemical assessments. We applied the appropriate sample weight (i.e., weight for socio-demographic and behavioral indicators). This ensured that the survey results were representative of the entire population. Cross-tabulations and chi-square tests were performed. We then run a bivariable logistic regression to assess the crude association between each explanatory variable and alcohol consumption. Following this, a multivariable logistic regression model was fitted to adjust for the effect of each explanatory variable. We used a backward stepwise approach to iteratively exclude variables that were not statistically significant. The significance of each predictor was evaluated using a p-value threshold of less than 0.05. All statistical analyses were conducted using Stata version 18 (Stata-Corp, College Station, TX) and Rv4.3.2.

### Results

#### Participants' characteristics

The study's weighted sample consisted of 1,136 participants, with 459 (40.4%) men and 677 (59.6%) women. Most of the participants were aged 50 years and older (47.7%), had primary/basic education (50.7%), resided in urban areas (62.3%), and were never married (37.4%). Only 7.1% were current smokers. More than half of the participants (62.8%) overweight/obese while 86.5% reported consuming processed food high in salt (Table 1).

#### Prevalence of alcohol consumption among persons living with hypertension

Overall, 784 (69.1%) of the total sample reported ever consuming alcohol in the last 12 months. The prevalence of alcohol consumption was high among men (88.4%,  $p < 0.001$ ), those aged 30–39 years (76.2%), and individuals with tertiary education (86.3%,  $p < 0.001$ ). Urban residents (75.4%,  $p < 0.001$ ), current smokers (86.8%,  $p = 0.004$ ), and those who consumed processed food high in salt (70.9%,  $p = 0.013$ ) had a high alcohol consumption rate. Participants who were overweight/obese had an alcohol consumption prevalence of 67.6% (see Table 1).

### Prevalence of alcohol use disorder

The study revealed that 22.8% of those who consumed alcohol experienced AUD. Specifically, alcohol dependence symptoms were prevalent in 13.7% of participants who consumed alcohol in the last 12 months. Social/family problem and functional impairments were prevalent in 11.6% and 8.2%, respectively (see Fig. 1).

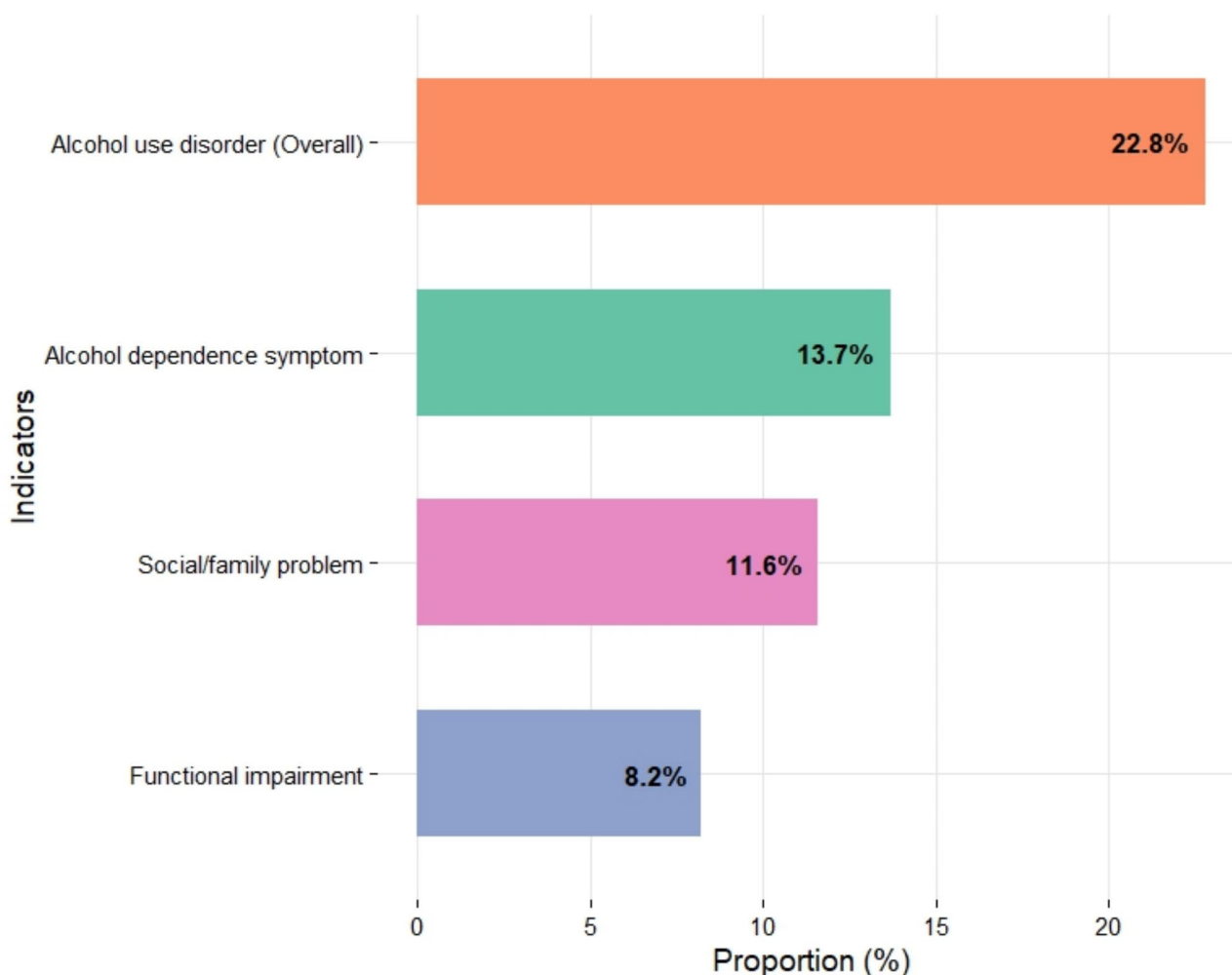
### Prevalence of alcohol use disorder by participant characteristics

The prevalence of AUD was high among men (28.5%), those aged 40–49 years (29.7%), and individuals with no formal education (24.4%). In terms of residence, rural reported a slightly higher prevalence at 23.4%. Higher prevalence of AUD was also observed among previously married persons (32.7%), current smokers (34.3%), and those who consume sodium saturated processed food (23.4%). Interestingly, persons living with hypertension who were not overweight/obese had a higher prevalence

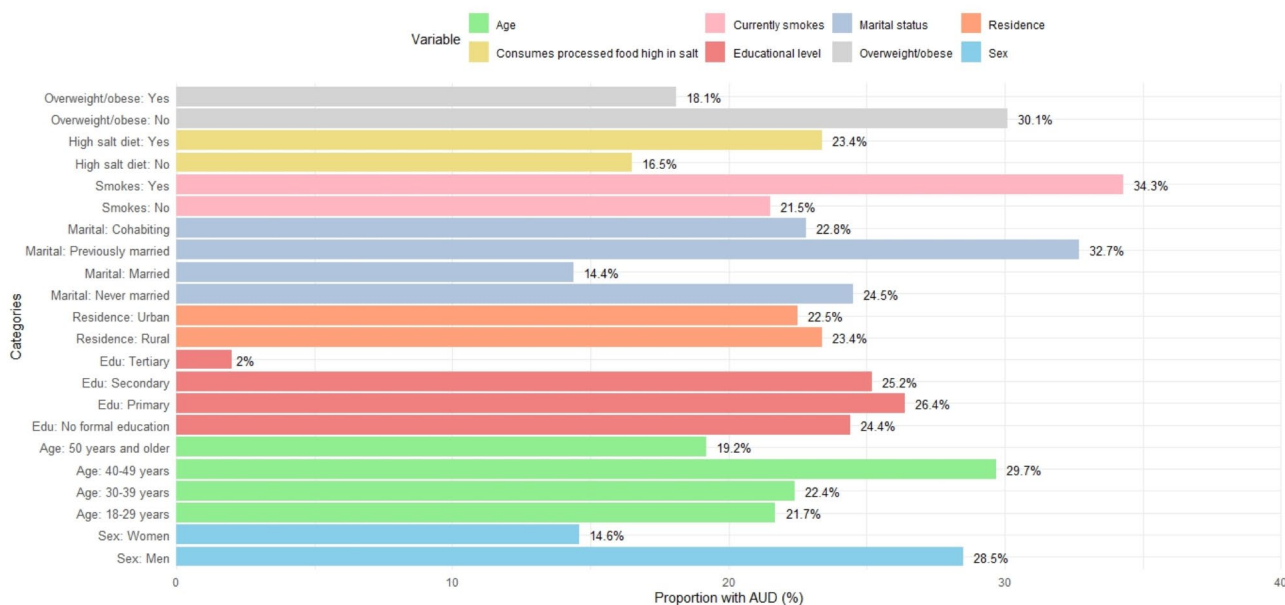
of AUD (30.1%) than their counterparts who were overweight/obese (18.1%) (see Fig. 2).

### Factors associated with alcohol consumption among persons living with hypertension

Women were significantly less likely to consume alcohol compared to men [AOR=0.17; 95% CI: 0.12–0.25] (Table 2). Additionally, individuals who consumed processed foods high in salt had more than twice the odds of consuming alcohol [AOR=2.34; 95% CI: 1.62–3.39]. Higher educational attainment remained a strong predictor, with those having tertiary education being over four times more likely to consume alcohol compared to individuals with no formal education [AOR=4.34; 95% CI: 1.97–9.55]. Urban residents were also significantly more likely to consume alcohol compared to rural residents [AOR=1.76; 95% CI: 1.33–2.31], and current smokers were more than twice as likely to consume alcohol compared to non-smokers [AOR=2.23; 95% CI: 1.13–4.38].



**Fig. 1** Prevalence of alcohol use disorder



**Fig. 2** Prevalence of alcohol use disorder by participant characteristics

**Factors associated with alcohol use disorder**

In Fig. 3, we present the results of the factors that significantly predicted AUD among persons living with hypertension. The findings indicate that women were less likely to experience AUD compared to men [AOR=0.32; 95%CI: 0.20–0.51]. Married individuals [AOR=0.43, 95%CI: 0.20–0.90] had lower odds of experiencing AUD compared to those never married. However, those with higher education [AOR=0.09, 95%CI: 0.02–1.87] and overweight/obese [AOR=0.58, 95%CI: 0.37–0.90] had significantly lower odds of experiencing AUD.

**Discussion**

**Prevalence and factors associated with alcohol use among persons with hypertension**

Recognizing the adverse effects of alcohol consumption on blood pressure, we sought to investigate the prevalence and associated factors of alcohol consumption among persons living with hypertension in Cape Verde. The study shows that more than two-thirds of Cape Verdeans living with hypertension (69.1%) had a lifetime prevalence of alcohol consumption. Thus, supporting the existing literature [2, 12–14] that identifies alcohol consumption as a significant modifiable high-risk factor for hypertension. The prevalence and odds of alcohol consumption among persons living with hypertension varied by sex. Women living with hypertension were significantly less likely to engage in alcohol consumption than men. This finding resonates with studies from Cape Verde [21] and Ghana [22] that had found higher alcohol consumption among men than in women. Previous studies from Cape Verde [21, 23] have shown that men

participate more in leisure and recreational activities than women. This higher participation exposes men to environments where alcohol consumption is more common, reinforcing a culture of drinking for social and recreational purposes.

Consistent with extant literature [20, 24], we observed that urban residents living with hypertension have a 79% higher likelihood to engage in alcohol consumption than those in the rural areas. Perhaps, this might be a proxy of the economic status and readily accessibility to alcoholic products in urban areas compared to rural areas. Urban environments typically offer greater accessibility to alcoholic products due to a higher density of retail outlets, bars, and restaurants [25]. Additionally, the availability of alcohol in urban areas is often coupled with marketing and promotional activities that encourage consumption.

Current smoking status was positively associated with alcohol consumption among persons living with hypertension. That is, current smokers were more likely than non-smokers to engage in alcohol consumption– a result that mirrors that of Boua et al. [26]. A plausible explanation for this observation could be that smoking and alcohol consumption are often co-occurring behaviors due to their shared social and psychological determinants [27]. Individuals who smoke might be frequent in social settings, such as bars and clubs, where alcohol is readily available and socially accepted, thereby increasing their likelihood of consuming alcohol. Another possible explanation is the potential occurrence of behavioral conditioning, where the consumption of one substance triggers cravings or habitual use of the other [28].



**Table 2** Factors associated with alcohol consumption among persons living with hypertension

Variables	Model I COR 95%CI	Model II AOR 95%CI
<b>Sex</b>		
Men	Ref.	Ref.
Women	<b>0.17 [0.12–0.23]***</b>	<b>0.17 [0.12–0.25]***</b>
<b>Age</b>		
18–29 years	Ref.	-
30–39 years	0.82 [0.45–1.49]	-
40–49 years	0.65 [0.37–1.14]	-
50 years and older	<b>0.43 [0.26–0.73]**</b>	-
<b>Educational level</b>		
No formal education	Ref.	Ref.
Primary/basic	<b>2.24 [1.57–3.20]***</b>	<b>1.76 [1.22–2.55]**</b>
Secondary/middle	<b>3.30 [2.13–4.92]***</b>	<b>2.10 [1.36–3.26]**</b>
Tertiary	<b>7.59 [3.62–15.93]***</b>	<b>4.34 [1.97–9.55]***</b>
<b>Residence</b>		
Rural	Ref.	Ref.
Urban	<b>1.71 [1.34–2.19]***</b>	<b>1.76 [1.33–2.31]***</b>
<b>Marital status</b>		
Never married	Ref.	-
Married	0.88 [0.64–1.22]	-
Previously married	0.77 [0.54–1.08]	-
Cohabiting	1.33 [0.95–1.87]	-
<b>Currently smokes</b>		
No	Ref.	Ref.
Yes	<b>2.53 [1.42–4.49]**</b>	<b>2.23 [1.13–4.38]*</b>
<b>Consumes processed food high in salt</b>		
No	Ref.	Ref.
Yes	<b>2.00 [1.44–2.78]***</b>	<b>2.34 [1.62–3.39]***</b>
<b>Overweight/obese</b>		
No	Ref.	-
Yes	0.86 [0.66–1.10]	-
<b>Model fitness</b>		
Prob > chi2		< 0.001
AIC		1291.088
Number of observations	1,136	1,136

\*\*\*p < 0.001, \*\*p < 0.01, \*p < 0.05; Ref: reference category; AIC: Akaike Information Criterion;

(-) variables excluded after the application of a backward stepwise approach.

One interesting finding was the association between education and alcohol consumption. It is expected that individuals who have high levels of education will have a better understanding of the risk posed by alcohol consumption on their blood pressure, and engage less in drinking. However, our findings indicate the contrary; individuals with higher educational attainment were 3.37 times more likely to engage in alcohol consumption. This is corroborated by a multi-country study involving four

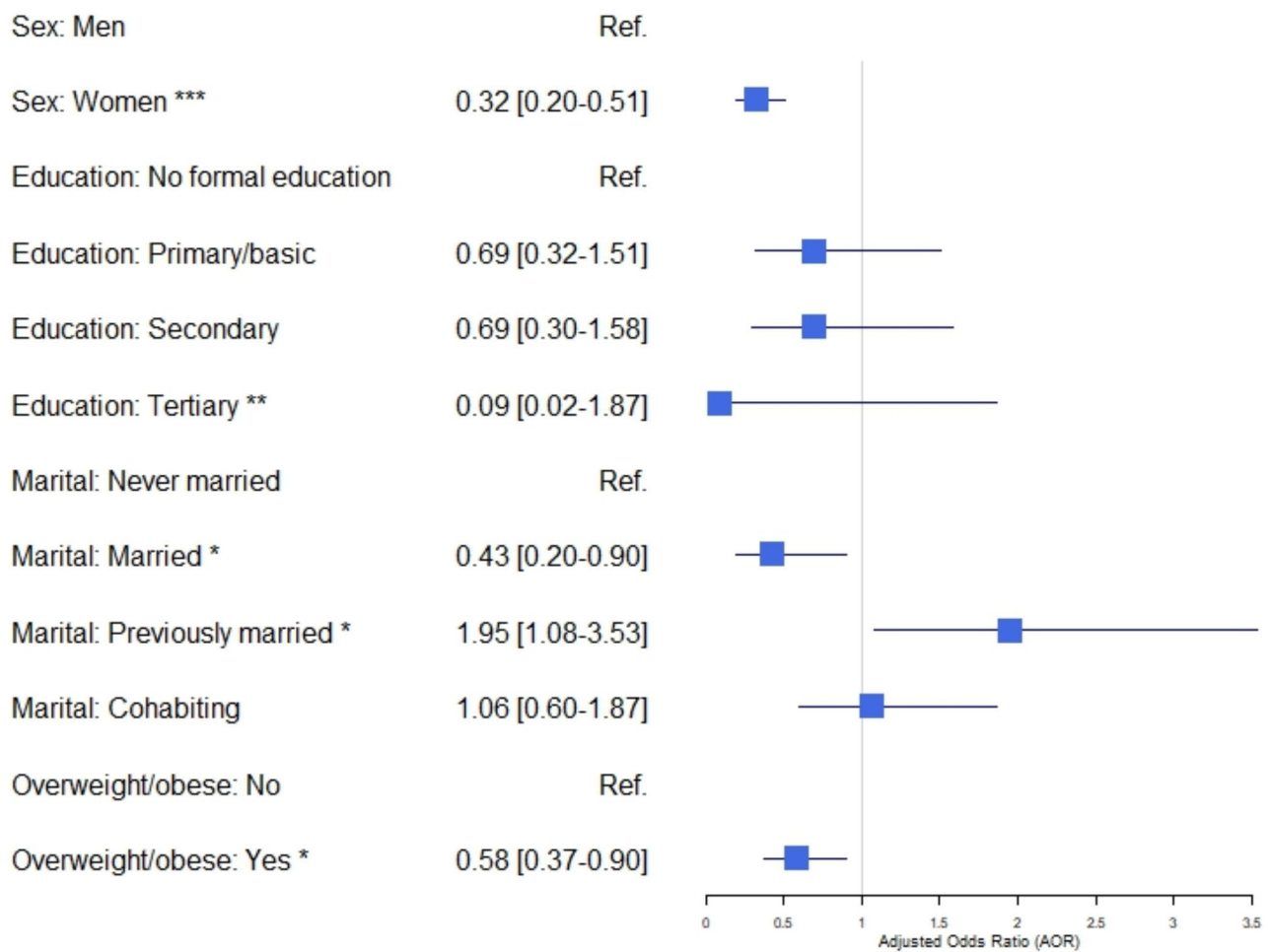
SSA countries [26] that found higher alcohol consumption among persons with formal education compared to those with no formal education. The observed association may be a proxy reflection of economic status as individuals with higher disposable incomes can more easily afford to buy alcohol. Another possible explanation could be the stress and demands of high-pressure careers that often accompany higher education levels might drive some individuals to use alcohol as a coping mechanism or a way to unwind.

**Prevalence and factors associated with alcohol use disorder among persons with hypertension**

It is evident from the study that two in ten (22.8%) Cape Verdean adults living with hypertension who consume alcohol experience AUD. The observed prevalence of AUD is similar to what has been reported among persons living with other chronic conditions such as HIV (22.0%) [29]. Also, the estimated prevalence of alcohol dependence (13.2%) is slightly higher than what has been reported in a previous that found a prevalence of 9.6% and 10.6%, among persons with uncontrolled and controlled hypertension, respectively [30]. Our analysis further revealed that women are less likely to experience AUD. This finding is consistent with prior studies that have found men to be at a higher risk of AUD [29, 31, 32]. The low prevalence of AUD among women compared to men could be attributable to ascribed gender norms and expectations where alcohol consumption is encouraged among men. As such, men tend to drink larger quantities of alcohol, putting them at greater risk for chronic heavy drinking. This is evident in the estimated prevalence of alcohol use by sex (men: 88.4% vs. women: 56.0%).

Even though individuals with higher education were more likely to use alcohol, their educational level was protective against AUD. Similar pattern of association is seen in a study conducted among Swedish patients that found a protective effect of higher education on the risk of AUD [33]. The findings also corroborate Latvala et al’s study [34] that found a significantly lower risk of AUD among individuals with a higher educational attainment. One possible explanation is that individuals with higher education levels may possess better knowledge of the risks associated with excessive alcohol consumption, leading to more moderate and controlled drinking behaviors.

Compared to the never married, AUD was significantly high among previously married individuals but lower among currently married people. The findings are in agreement with extant studies [35, 36] that reported a higher risk of AUD among individuals who were never married or had divorced/separated. Divorce and separation can bring about significant financial, social, and psychological strain, potentially increasing vulnerability to



**Fig. 3** Forest plot of results from multivariable logistic regression analysis of the factors associated with AUD among persons living with hypertension \*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ ; Ref: reference category. **NB** Backward stepwise approach was used to iteratively exclude statistically non-significant variables

alcohol misuse and AUD. In contrast, those who are currently married may benefit from the social and emotional support provided by a partner, which can act as a protective factor against excessive alcohol use [36]. However, inverse association between overweight/obese status and AUD was unexpected as previous studies document a positive association [37]. It is unclear why this association pertains. Future studies would have to deeply explore the association between obesity status and AUD.

**Implications for policy and practice**

Given the estimated high prevalence of alcohol consumption, it is imperative for healthcare providers to routinely screen for alcohol use among hypertensive patients and provide counseling on the importance of reducing alcohol intake. Our findings also underscore a need for health messages that are culturally relevant and tailored to resonate with men, emphasizing the specific health risks associated with alcohol consumption, such as its detrimental impact on blood pressure and overall

cardiovascular health. Such tailored health messages must provide practical advice on how to decrease alcohol consumption and suggest healthier alternatives for socializing and recreation. Furthermore, recognizing the increased risk of AUD among previously married individuals suggests the need for psychosocial support services for those experiencing divorce or separation. In contrast, the protective role of marriage in reducing AUD risk points to the value of strengthening social support systems. Finally, the unexpected inverse association between obesity and AUD requires further exploration, prompting future research to investigate the complex relationships between alcohol use, weight, and health outcomes.

**Strengths and limitations**

A major limitation of this study is the absence of a temporal variable to assess when the individual developed hypertension. As such, we are unable to determine whether alcohol consumption in this study occurred before the development of hypertension, or after being

diagnosed of hypertension. Therefore, caution must be exercised when making generalizations about the study. Also, the cross-sectional nature of the study does not permit us to establish any causal relationships. Nevertheless, the multi-stage sampling technique employed in the collection of the data, as well as the application of sample weights ensures that that our findings are generalizable to the larger adult population of Cape Verde. Additionally, we applied appropriate statistical methods to arrive at the results. Thus, contributing to the validity of the study.

## Conclusion

The study revealed that over two-thirds of persons living with hypertension in Cape Verde have ever consumed alcohol, and among them, 22.8% had experienced AUD. The high prevalence of alcohol consumption and AUD among persons living with hypertension in Cape Verde signals a critical need for targeted public health strategies. Interventions should prioritize men, urban residents, current smokers, and individuals with higher education, given their higher likelihood of alcohol consumption. Additionally, given the lower likelihood of AUD among highly educated individuals, yet their higher alcohol consumption rates, interventions should balance education on the risks of excessive alcohol use while promoting responsible drinking.

## Abbreviations

AOR	Adjusted Odds Ratio
AUD	Alcohol Use Disorder
COR	Crude Odds Ratio
CI	Confidence Interval
Ref	Reference Category

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We acknowledge the WHO for granting us free access to the dataset used in this study.

## Author contributions

JO and CA conceptualized and designed the study. JO curated the data and performed the formal analyses. JO and CA drafted the initial manuscript. KSD reviewed the initial manuscript for its accuracy. All authors reviewed the final manuscript and approved its submission. JO had the final responsibility of submitting the manuscript.

## Funding

None.

## Data availability

The datasets generated and/or analysed during the current study are available in the WHO NCD Microdata Repository: <https://extranet.who.int/ncdsmicrodata/index.php/catalog/935>. Accession number/ID: CPV\_2020\_STEPS\_v01.

## Declarations

### Consent for publication

Not applicable.

### Competing interests

The authors declare no competing interests.

## Ethical approval and consent to participate

We did not seek ethical approval as this has already been done for all the STEPS surveys of NCD risk factors. Rather, we formally requested the data from the WHO NCD Microdata Repository: <https://extranet.who.int/ncdsmicrodata/index.php/home>.

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