

# Association of Alcohol Consumption and Blood Pressure in Some Low Socioeconomic Groups from Andhra Pradesh, India

Yadlapalli Sriparvati Kusuma<sup>1,2</sup>, Bontha Veerraju Babu<sup>1,3</sup> and Jammigumpula Masthannaiah Naidu<sup>1</sup>

<sup>1</sup> Department of Anthropology, Andhra University, Visakhapatnam, India

<sup>2</sup> Centre for Community Medicine, All India Institute of Medical Sciences, New Delhi, India

<sup>3</sup> Indian Council of Medical Research, New Delhi, India

## ABSTRACT

*The present paper examines the relationship of alcohol consumption with blood pressure (BP) levels and hypertension prevalence. Data on BP, alcohol consumption and anthropometry were obtained from a cross sectional sample of 1316 adult men and women of six low socioeconomic groups belonging to four different ethnic groups from Visakhapatnam district of Andhra Pradesh, India. Considerable proportions of respondents reported the consumption of alcohol. Some groups recorded higher levels of systolic and diastolic BP among alcohol drinkers than non-drinkers, and in others it was reverse. There was no uniform association between alcohol consumption and hypertension prevalence, though the combined data revealed a higher prevalence of hypertension among non-drinker men and drinker women. The present study population was a heterogeneous group in terms of alcohol consumption, and many of them were occasional drinkers. The study revealed no consistent association of alcohol consumption with blood pressure. The study opines that it is necessary to take measures to reduce the prevalence of alcohol consumption, as it was an underlying social problem and, though not directly associated with blood pressure; and alcohol consumption has been demonstrated as a major risk factor for cardiovascular diseases.*

**Key words:** alcohol, hypertension, blood pressure, epidemiology

## Introduction

Around 4 % of the global disease burden is thought to be alcohol related, which is comparable with that attributed to the effects of tobacco (4.1 %) and high blood pressure (BP) (4.4 %) <sup>1</sup>. The relation between alcohol consumption and hypertension was well known and the restriction of alcohol intake was recommended in the management of hypertension <sup>2</sup>. Initial interests in the relationship between alcohol intake and hypertension date back to 1915 when Lian, a French physician, described his findings amongst wine-drinking French men <sup>3</sup>. Both cross-sectional and prospective epidemiological studies have established a relationship between hypertension and alcohol consumption <sup>4</sup>. Interestingly, a J-shaped association exists between alcohol consumption and BP <sup>5</sup>, where lower BP levels were associated with low levels of alcohol intake, when compared with teetotalers or those drinking three or more drinks per day <sup>6</sup>. Nonetheless, prospective studies have indicated increased BP over

time and an elevated risk of developing overt hypertension with consumption of alcohol <sup>7</sup>. Hypertension has emerged as one of the major health burdens in India, as studies have shown upward trend in the prevalence of hypertension and other cardiovascular risks <sup>8</sup>. However, there were no enough studies from India, revealing the association of alcohol consumption with BP and hypertension. The present study aims to examine the association of alcohol consumption with blood pressure in six low socioeconomic groups belonging to four ethnic communities from a district of South India.

## Subjects and Methods

Data from six low socio economic groups belonging to four ethnic communities inhabiting tribal, rural and urban areas of the Visakhapatnam district of Andhra Pra-

desh forms the basis for this paper. The sample was collected from two tribal groups (Khondh and Valmiki) living in the tribal area, and two caste groups viz., Wadabalija (from rural and urban) and Settibalija (from rural and urban area). The details of the selected groups and sampling strategy were given elsewhere<sup>9</sup>. Data pertaining to BP and drinking habit were collected from men and women aged 20 years and above, after obtaining the informed consent. BP was measured by using mercury sphygmomanometer as per the standard procedure<sup>10</sup>. People were considered as hypertensive if they possessed systolic BP (SBP) of  $\geq 140$  mm Hg and/or diastolic BP (DBP) of  $\geq 90$  mm Hg. The pre-hypertension is the

category of people who possessed SBP of 120–139 mm Hg and/or DBP 80–89 mm Hg. None of the respondents were aware of their hypertension status. The information pertaining to the alcohol habit was collected through interview with a schedule. Based on the habit of alcohol consumption, respondents were classified into non-drinkers (who never drink alcohol or other local brewed alcoholic beverages), occasional drinkers (who consume alcohol or other local brewed alcoholic beverages only occasionally) and regular drinkers (who consume alcohol or other local brewed alcoholic beverages at least three times a week). People with the habit of consuming local brewed alcoholic beverages and branded liquors were

**TABLE 1**  
MEANS AND CORRESPONDING STANDARD DEVIATIONS OF SYSTOLIC AND DIASTOLIC BLOOD PRESSURE AMONG NON-DRINKERS AND DRINKERS BY POPULATION GROUPS

	Non-drinkers	Occasional drinkers	Regular drinkers	F values
<b>Systolic blood pressure</b>				
Khondh men (n=115)	117.61 ± 14.45	116.03 ± 12.46	116.64 ± 10.85	0.16 <sup>NS</sup>
Khondh women (n=113)	118.57 ± 13.67	116.63 ± 15.10	–	0.51 <sup>NS</sup>
Valmiki men (n=111)	132.14 ± 35.80	122.19 ± 21.66	119.77 ± 19.45	1.85 <sup>NS</sup>
Valmiki women (n=111)	129.95 ± 25.30	135.96 ± 26.60	108.00	0.99 <sup>NS</sup>
Rural Wadabalija men (n=106)	120.40 ± 12.03	123.10 ± 19.04	127.36 ± 24.71	0.91 <sup>NS</sup>
Rural Wadabalija women (n=111)	118.91 ± 23.75	–	–	–
Urban Wadabalija men (n=103)	114.15 ± 14.44	120.62 ± 17.59	120.58 ± 20.31	0.74 <sup>NS</sup>
Urban Wadabalija women (n=103)	117.62 ± 23.84	147.00 ± 24.27	–	4.42*
Rural Settibalija men (n=104)	131.40 ± 21.11	125.02 ± 23.24	124.80 ± 22.33	0.69 <sup>NS</sup>
Rural Settibalija women (n=117)	123.55 ± 25.72	148.00 ± 39.60	–	1.76 <sup>NS</sup>
Urban Settibalija men (n=107)	124.75 ± 20.64	120.43 ± 13.31	122.35 ± 11.39	0.76 <sup>NS</sup>
Urban Settibalija women (n=115)	122.35 ± 22.97	130.33 ± 40.29	–	0.63 <sup>NS</sup>
Total men (n=646)	123.63 ± 21.89	120.89 ± 18.11	122.85 ± 19.98	1.19 <sup>NS</sup>
Total women (n=670)	121.79 ± 23.66	125.18 ± 23.87	108.00	0.98 <sup>NS</sup>
<b>Diastolic blood pressure</b>				
Khondh men (n=115)	73.35 ± 10.50	73.26 ± 8.43	74.00 ± 8.45	0.04 <sup>NS</sup>
Khondh women (n=113)	75.52 ± 7.58	73.83 ± 10.42	–	1.00 <sup>NS</sup>
Valmiki men (n=111)	75.18 ± 12.68	72.85 ± 9.39	70.94 ± 9.51	1.19 <sup>NS</sup>
Valmiki women (n=111)	76.12 ± 12.03	77.68 ± 12.14	71.00	0.28 <sup>NS</sup>
Rural Wadabalija men (n=106)	76.45 ± 7.92	75.90 ± 9.33	76.69 ± 12.29	0.06 <sup>NS</sup>
Rural Wadabalija women (n=111)	73.23 ± 12.78	–	–	–
Urban Wadabalija men (n=103)	65.92 ± 7.74	76.55 ± 11.07	79.29 ± 12.66	6.45**
Urban Wadabalija women (n=103)	74.20 ± 12.19	81.33 ± 16.77	–	0.98 <sup>NS</sup>
Rural Settibalija men (n=104)	82.40 ± 9.02	80.26 ± 12.75	82.33 ± 11.09	0.42 <sup>NS</sup>
Rural Settibalija women (n=117)	78.86 ± 11.21	79.50 ± 7.78	–	0.01 <sup>NS</sup>
Urban Settibalija men (n=107)	79.64 ± 9.94	79.70 ± 10.70	79.39 ± 8.01	0.01 <sup>NS</sup>
Urban Settibalija women (n=115)	78.48 ± 11.97	82.33 ± 20.06	–	0.55 <sup>NS</sup>
Total men (n=646)	76.06 ± 11.19	76.31 ± 10.67	77.01 ± 11.33	0.34 <sup>NS</sup>
Total women (n=670)	76.16 ± 11.81	75.95 ± 11.94	71.00	0.11 <sup>NS</sup>

\* $p < 0.05$ , \*\* $p < 0.01$

<sup>NS</sup>Not significant

also considered as drinkers. Also, anthropometric measurements were collected through standard procedures<sup>11</sup>. The purpose of the study was explained and informed consent was taken from all the participants before data collection.

The prevalence of hypertension as well as the mean levels of adjusted and unadjusted SBP and DBP were compared among non-drinkers, occasional drinkers and regular drinkers. The data of SBP and DBP were adjusted for the influence of established predictors by the following steps: (i) Each BP was regressed on age, age<sup>2</sup>, pulse rate, body mass index, waist-hip ratio, sum of three trunkal (subscapular, suprailiac and abdominal) skin folds and sum of three extremity (triceps, biceps and medial calf) skin folds in a stepwise manner, retaining only those terms which were significant at 5 % level; (ii) separate regression analyses were done for SBP and DBP in each sex of each group; (iii) predicted value of each BP (SBP and DBP) is calculated for each individual through the corresponding regression equation. (iv) the predicted value of each BP is subtracted from the originally measured value of the BP for each individual and these were called residual values; (v) the adjusted value of the BP (SBP or DBP) for each individual was obtained (adjusted BP = unadjusted population mean  $\pm$  residual value for each individual).

## Results

The habit of alcohol consumption is considerable among the present study populations (79.3% of men and 13.7 % of women consume alcohol). Among men, the highest prevalence of alcohol drinking was reported among urban Wadabalija (87.4 %), followed by rural

Wadabalija (81.1 %), rural Settibalija (80.8 %), Valmiki (80.2 %), urban Settibalija (73.8 %) and Khondh (73.0 %). Among women, the highest prevalence was found among the Khondh (46.0 %) followed by Valmiki (26.1 %), urban Settibalija (5.2 %), urban Wadabalija (2.9 %) and rural Settibalija (1.7 %). Thus, a very few women of rural and urban populations, and none of the rural Wadabalija women reported the habit of alcohol consumption. All women drinkers except one reported that they consume alcohol only occasionally. Among men, a higher proportion were occasional drinkers and on the whole, around 1/5<sup>th</sup> of men (20.7%) were non-drinkers, slightly more than half of the men (52.8%) were occasional drinkers and around 1/4<sup>th</sup> of the men (26.5%) were regular drinkers. Table 1 presents the mean values of SBP and DBP among non-drinkers, occasional drinkers and regular drinkers by sex and population group. With regard to SBP, men of all groups except Wadabalija recorded higher levels among non-drinkers. While all women but Khondh recorded higher means among drinkers. In urban Wadabalija women, drinkers (occasional) recorded significantly higher SBP than non-drinkers, but the proportion of drinking women was very small. Diastolic levels also did not reveal any consistent pattern according to the habit of alcohol consumption, however, DBP levels were significantly higher in drinkers than non-drinkers among urban Wadabalija men. The prevalence of hypertension by the habit of alcohol consumption among men and women of all groups (Table 2) revealed that there was no uniform association between alcohol consumption and hypertension prevalence. Among men of rural and urban Wadabalija, the hypertension prevalence was higher among drinkers than non-drinkers. Among women, similar situation was noted in Valmiki tribe and rural Settibalija.

TABLE 2  
PREVALENCE OF PRE-HYPERTENSION AND HYPERTENSION AMONG NON-DRINKERS AND DRINKERS BY POPULATION GROUPS

	Normal	Pre-hypertensives	Hypertensives	Chi-square
<b>Khondh men</b>				
Non-drinkers (n=31)	16 (51.6)	10 (32.3)	5 (16.1)	2.63 <sup>NS</sup>
Occasional drinkers (n=70)	37 (52.9)	30 (42.9)	3 (4.3)	
Regular drinkers (n=14)	6 (42.9)	7 (50.0)	1 ((7.1)	
<b>Khondh women</b>				
Non-drinkers (n=61)	31 (50.8)	24 (39.3)	6 (9.8)	0.36 <sup>NS</sup>
Occasional drinkers (n=52)	25 (48.1)	20 (38.5)	7 (13.5)	
Regular drinkers (n=0)	–	–	–	
<b>Valmiki men</b>				
Non-drinkers (n=22)	9 (40.9)	9 (40.9)	4 (18.2)	0.13 <sup>NS</sup>
Occasional drinkers (n=54)	29 (53.7)	18 (33.3)	7 (13.0)	
Regular drinkers (n=35)	19 (54.3)	12 (34.3)	4 (11.4)	
<b>Valmiki women</b>				
Non-drinkers (n=82)	31 (37.8)	26 (31.7)	25 (30.5)	0.54 <sup>NS</sup>
Occasional drinkers (n=28)	9 (32.1)	8 (28.6)	11 (39.3)	
Regular drinkers (n=1)	1 (100.0)	–	–	

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Rural Wadabalija men				
Non-drinkers (n=20)	8 (40.0)	9 (45.0)	3 (15.0)	0.37 <sup>NS</sup>
Occasional drinkers (n=41)	16 (39.0)	15 (36.6)	10 (24.4)	
Regular drinkers (n=45)	18 (40.0)	16 (35.6)	11 (24.4)	
Rural Wadabalija women				
Non-drinkers (n=111)	65 (58.6)	24 (21.6)	22 (19.8)	–
Occasional drinkers (n=0)	–	–	–	
Regular drinkers (n=0)	–	–	–	
Urban Wadabalija men				
Non-drinkers (n=13)	9 (69.2)	3 (23.1)	1 (7.7)	0.47 <sup>NS</sup>
Occasional drinkers (n=66)	29 (43.9)	24 (36.4)	13 (19.7)	
Regular drinkers (n=24)	10 (41.7)	9 (37.5)	5 (20.8)	
Urban Wadabalija women				
Non-drinkers (n=100)	61 (61.0)	22 (22.0)	17 (17.0)	–
Occasional drinkers (n=3)	1 (33.3)	–	2 (66.7)	
Regular drinkers (n=0)	–	–	–	
Rural Settibalija men				
Non-drinkers (n=20)	5 (25.0)	7 (35.0)	8 (40.0)	1.81 <sup>NS</sup>
Occasional drinkers (n=54)	20 (37.0)	19 (35.2)	15 (27.8)	
Regular drinkers (n=30)	14 (46.7)	10 (33.3)	6 (20.0)	
Rural Settibalija women				
Non-drinkers (n=115)	45 (39.1)	46 (40.0)	24 (20.9)	–
Occasional drinkers (n=2)	–	1 (50.0)	1 (50.0)	
Regular drinkers (n=0)	–	–	–	
Urban Settibalija men				
Non-drinkers (n=28)	12 (42.9)	7 (25.0)	9 (32.1)	0.49 <sup>NS</sup>
Occasional drinkers (n=56)	19 (33.9)	22 (39.3)	15 (26.8)	
Regular drinkers (n=23)	6 (26.1)	12 (52.2)	5 (21.7)	
Urban Settibalija women				
Non-drinkers (n=109)	56 (51.4)	25 (22.9)	28 (25.7)	0.00 <sup>NS</sup>
Occasional drinkers (n=6)	3 (50.0)	1 (16.7)	2 (33.3)	
Regular drinkers (n=0)	–	–	–	
Total men				
Non-drinkers (n=134)	59 (44.0)	45 (33.6)	30 (22.4)	1.54 <sup>NS</sup>
Occasional drinkers (n=341)	150 (44.0)	128 (37.5)	63 (18.5)	
Regular drinkers (n=171)	73 (42.7)	66 (38.6)	32 (18.7)	
Total women				
Non-drinkers (n=578)	289 (50.0)	167 (28.9)	122 (21.1)	0.71 <sup>NS</sup>
Occasional drinkers (n=91)	38 (41.8)	30 (33.0)	23 (25.3)	
Regular drinkers (n=1)	1 (100.0)	–	–	

<sup>NS</sup>Not significant, figures in parenthesis are percentages

The combined data revealed a higher prevalence of hypertension among non-drinker men and drinker women than their counterparts. Also, it is to be noted that significant ethnic differences in the prevalence of hypertension were recorded among both men ( $p < 0.001$ ) and women ( $p < 0.01$ ). However, there were no significant differences in the prevalence of hypertension between urban and rural samples ( $p > 0.05$ ) and between men and women ( $p > 0.05$ ).

The mean levels of adjusted SBP and DBP among hypertensives and normotensives were compared between non-drinkers, occasional drinkers and regular drinkers (Table 3). No uniform trend of association between alcohol consumption and BP was observed. Among hypertensives, male non-drinkers (than male drinkers) and women non-drinkers (than women drinkers) recorded higher levels of adjusted BP, however the differences were not significant. Among normotensives, neither SBP

**TABLE 3**  
MEAN AND CORRESPONDING STANDARD DEVIATIONS OF SYSTOLIC AND DIASTOLIC BLOOD PRESSURE BY DRINKING STATUS  
AMONG HYPERTENSIVES AND NORMOTENSIVES

Category of sample		Systolic blood pressure		Diastolic blood pressure	
		unadjusted	adjusted	unadjusted	adjusted
<b>Total sample</b>					
Men	Non-drinkers (n=134)	123.63 ± 21.89	123.34 ± 16.65	76.06 ± 11.19	76.15 ± 9.94
	Occasional drinkers (n=341)	120.89 ± 18.11	121.08 ± 15.00	76.31 ± 10.67	76.45 ± 9.83
	Regular drinkers (n=171)	122.85 ± 19.98	122.54 ± 16.80	77.01 ± 11.33	76.83 ± 10.22
	F – value	1.19 <sup>NS</sup>	1.15 <sup>NS</sup>	0.34 <sup>NS</sup>	0.10 <sup>NS</sup>
Women	Non-drinkers (n=578)	121.79 ± 23.66	121.84 ± 19.22	76.16 ± 11.81	76.24 ± 11.04
	Occasional drinkers (n=91)	125.18 ± 23.87	122.67 ± 19.00	75.95 ± 11.94	75.50 ± 10.86
	Regular drinkers (n=1)	108.00	83.93	71.00	66.35
	F – value	1.61 <sup>NS</sup>	0.15 <sup>NS</sup>	0.02 <sup>NS</sup>	0.35 <sup>NS</sup>
<b>Hypertensives</b>					
Men	Non-drinkers (30)	151.23 ± 27.77	141.12 ± 18.92	90.20 ± 9.01	86.38 ± 8.11
	Occasional drinkers (n=63)	147.54 ± 19.62	137.61 ± 15.04	89.86 ± 9.85	86.64 ± 9.86
	Regular drinkers (n=32)	151.56 ± 23.50	140.60 ± 21.79	93.03 ± 9.43	88.76 ± 10.29
	F – value	0.45 <sup>NS</sup>	0.52 <sup>NS</sup>	1.24 <sup>NS</sup>	0.64 <sup>NS</sup>
Women	Non-drinkers (n=122)	157.81 ± 22.64	144.16 ± 20.73	90.57 ± 12.80	86.85 ± 12.74
	Occasional drinkers (n=23)	158.48 ± 20.72	142.88 ± 21.37	88.13 ± 12.49	84.80 ± 12.86
	Regular drinkers (n=0)	–	–	–	–
	F – value	0.02 <sup>NS</sup>	0.07 <sup>NS</sup>	0.71 <sup>NS</sup>	0.50 <sup>NS</sup>
<b>Normotensives</b>					
Men	Non-drinkers (n=104)	115.66 ± 10.75	118.22 ± 11.78	71.98 ± 7.99	73.20 ± 8.35
	Occasional drinkers (n=278)	114.85 ± 10.86	117.34 ± 12.22	73.24 ± 8.18	74.14 ± 8.23
	Regular drinkers (n=139)	116.24 ± 11.52	118.38 ± 12.17	73.32 ± 8.07	74.08 ± 8.01
	F – value	0.78 <sup>NS</sup>	0.43 <sup>NS</sup>	1.06 <sup>NS</sup>	0.53 <sup>NS</sup>
Women	Non-drinkers (n=456)	112.15 ± 11.51	115.87 ± 13.60	72.30 ± 7.92	73.40 ± 8.56
	Occasional drinkers (n=68)	113.91 ± 10.72	115.84 ± 12.14	71.82 ± 8.49	72.35 ± 8.02
	Regular drinkers (n=1)	108.00	83.93	71.00	66.35
	F-value	1.41 <sup>NS</sup>	0.00 <sup>NS</sup>	0.21 <sup>NS</sup>	0.90 <sup>NS</sup>

<sup>NS</sup>Not significant

nor DBP differ significantly between non-drinkers and drinkers.

## Discussion

The habit of consuming alcohol is prevalent in these communities and is more among men. The present study results reveal no association of alcohol consumption with BP levels and hypertension prevalence. Consumption of single alcohol drink may cause an acute rise in BP that resolves within few hours<sup>12</sup> and consumption of alcohol for several days may cause a more sustained rise in BP<sup>13</sup>. Saunders et al.<sup>7</sup> observes that in drinkers, hypertension was common but settles after withdrawal from alcohol. It indicated that alcohol may only exert a short-term effect on BP. The present study population was a heterogeneous group in terms of alcohol consumption, and many of them are light and periodic drinkers. This could be a

reason for lack of significant differences between drinkers and non-drinkers. This was consistent with clinical studies that have demonstrated a rise in BP after 3–4 days of regular alcohol consumption, with pressure settling to normal levels after a similar period of abstinence<sup>13</sup>. In the present study, the details of alcohol consumption have not been studied. Lack of data on type, quantity and pattern of drinking is a limitation of this study. Many studies provided supportive evidence for the suggestion that alcohol has a slow pressor effect that is quite reversible<sup>14</sup>. If alcohol does have such reversible effect on BP, then it is possible that it does not cause sustained hypertension. Also, the mechanisms underlying the relationship between alcohol and BP remain ambiguous, though several have been proposed<sup>15</sup>. It is known that light to moderate drinking could have cardio-protective effects mediated through modifications in lipid and coagulation profiles, as well as lowering of BP and va-

sodilatation. Hence, would they benefit from drinking in moderation rather than 100 % abstinence per se? There is now substantial evidence linking high alcohol consumption with stroke<sup>16</sup> and to a lesser extent with coronary heart disease<sup>17</sup> and it is possible that alcohol-induced hypertension partially mediates these associations. The practical message is clear: alcohol is an important risk factor for several health and social problems. Ceccanti et al.<sup>18</sup> do conclude that complete alcohol abstinence 'must be recommended to all hypertensive alcohol drinkers', although alcohol withdrawal-induced transient hypertension was harmless, and abstinence led to a com-

plete recovery from hypertension in most cases. Clearly, this is relevant to the great burden of hypertension on cardiovascular disease<sup>19</sup>, and abstinence of alcohol features as part of non-pharmacological management in current hypertension treatment guidelines<sup>20</sup>.

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Y. S. Kusuma

Centre for Community Medicine, All India Institute of Medical Sciences, Ansari Nagar, New Delhi 110 029, India  
email: kusumays@gmail.com

## POVEZANOST KONZUMACIJE ALKOHOLA I KRVNOG TLAKA U NEKIM NIŽIM SOCIO-EKONOMSKIM SKUPINAMA IZ ANDHRA PRADESHA, INDIJA

### SAŽETAK

Ovaj rad istražuje povezanost konzumacije alkohola sa razinama krvnog tlaka i učestalošću hipertenzije. Podaci o krvnom tlaku, konzumaciji alkohola i antropometriji uzeti su iz poprečno-presječnog uzorka 1.316 odraslih žena i muškaraca iz 6 nižih socio-ekonomskih skupina koje pripadaju četirima različitim etničkim grupama iz Visakhapatnam regije, države Andhra Pradesh, Indija. Velik dio onih koji su se odazvali konzumiralo je alkohol. Neke grupe bilježile su više razine sistoličkog i dijastoličkog krvnog tlaka među ispitanicima koji su konzumirali alkohol, a u ostalim grupama bilo je obrnuto. Nije bilo ravnomjerne povezanosti između konzumacije alkohola i učestalosti hipertenzije iako su kombinirani podaci otkrili višu učestalost hipertenzije među muškarcima koji nisu konzumirali alkohol i ženama koje jesu. Ova studija bila je rađena na heterogenim grupama što se tiče konzumacije alkohola, a mnogi od njih bili su povremeni konzumenti. Studija nije pokazala značajnu povezanost konzumacije alkohola sa krvnim tlakom. Studija pretpostavlja da je nužno poduzeti mjere smanjenja učestalosti konzumacije alkohola kao da se radi o značajnom socijalnom problemu, a bez obzira što nije direktno povezan sa krvnim tlakom. Konzumacija alkohola je prikazana kao veliki faktor rizika za razvoj kardiovaskularnih bolesti.