The Prevalence, Awareness, Management and Control of Hypertension in Men and Women in Benin, West Africa: the TAHES study.

Ileana Desormais (ileana.desormais@orange.fr)
Hopital Dupuytren https://orcid.org/0000-0003-3728-568X
Salimanou Ariyoh Amidou
Faculty of Health Science, Cotonou
Yessito Corine Houehanou
Faculty of Health Science, Cotonou
Stephan Dismand Houinato
Faculty of Health Science, Cotonou
Gwladys Nadia Gbagouidi
Faculty of Health Science Cotonou
Pierre Marie Preux
INSEM 1094 Limoges
Victor Aboyans
Department of cardiology, Dupuytren University Hospital Limoges
Philippe Lacroix
Hopital Dupuytren

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Abstract

Background Sub-Saharan Africa is facing a growing burden of non-communicable diseases, including cardiovascular diseases (CVDs), due to epidemiological transitions. Among their risk factors, hypertension is a major determinant of CVDs, but the prevalence and level of awareness and management of this condition are poorly studied in African populations. The aim of this study was to determine the prevalence of hypertension and identify its associated risk factors as well as the awareness and management of this condition in a community-dwelling cohort in Benin. Methods A cross-sectional door-to-door study was conducted in the population over the age of 25 years in Tanve, a rural setting in Benin. The questionnaire and anthropometric measurements of the World Health Organization STEPWISE survey were used. Blood pressure was measured using standard procedures. Results The sample included 1777 subjects (60.9% females, mean age was 42.5±16.5 years). The prevalence of hypertension was 32.9%, similar in men (32.8%) and women (33.0%, p=0.9342). Age and obesity were significantly associated with hypertension. Less than half (42%) of hypertensive people were aware about their condition and only 46.3% of them were treated. Awareness ratios differed between men and women (respectively 32.9% vs. 47.5%; p= 0.0039) and was not influenced by age, education, occupation, marital status or income. Female sex was the only factor associated with better controlled HTN, independent of socio-economic parameters. Conclusion This large population-based study confirms the high prevalence, low awareness, and low control of hypertension in men and women in sub-Saharan Africa. Only half of the populations with hypertension are aware of their hypertension, indicating a high burden of undiagnosed and un-controlled high blood pressure in these populations.

Background

In 2015, the global number of hypertensive people was estimated at almost 1.13 billion(1) with a prevalence of hypertension (HTN) within the 30%-45% range in adults(2). Since HTN is a major risk factor for cardiovascular diseases (CVDs), especially ischemic heart disease and stroke(3), the global burden of morbidity and mortality related to HTN becomes one of the major public health concerns worldwide.

This high prevalence seems consistent across the world, irrespective of income status, i.e. in lower-income, middle-income and higher-income countries(2). Given the increasing prevalence of HTN with advancing age(2) and the trends for population ageing and increased sedentary lifestyle and obesity, the prevalence of HTN is expected to increase. It has been predicted that by 2025 the number of hypertensive individuals will increase by 15-20%, nearing one and a half billion(4). Few population-based studies indicate that hypertension is a widespread problem in sub-Sahara Africa (SSA) too, with a prevalence up to 38% in some communities (5, 6). It is estimated that out of the approximately 650 million people in SSA, between 10 to 20 million may have hypertension. These estimations are based on scarce heterogenous studies in the past and many countries in SSA still lack detailed recent basic data on the prevalence of HTN(7). Furthermore, few studies have reported on the proportion of awareness, treatment and good control of HTN in these populations which present socio-economic particularities.

Nevertheless, the study on hypertension conducted in general population in Benin, in 2008, showed an alarming prevalence of 28%(8) This condition was highly undiagnosed, as 78% of the subjects were unaware of their high blood pressure.

Our aim was to estimate the prevalence of hypertension, to identify its associated risk factors and assess the level of awareness and management of hypertension in a rural area of Benin in West Africa.

Methods

Study population

This is an analysis of inclusion data collected in the TAnve HEalth Study (TAHES) a prospective population-based cohort study initiated in 2015 in Tanve, a rural setting 150 km north of Cotonou, the capital of Benin. The TAHES involved all adults above 25 years old living in Tanve(9). Its main objective is to assess the frequency of CVDs and their associated risk factors. Exclusion criteria were pregnant women and refusals to participate.

All participants and/or their families gave informed consent prior to inclusion in the study. Written consent was obtained whenever feasible. For illiterate people, the study's objectives were verbally explained and consent was obtained by thumbprint.

The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki and had prior approval of the Benin national health's research ethics committee and the "Comité de Protection des Personnes du Sud-Ouest et d'Outre-Mer 4 in France".

Data collection

An exhaustive sampling using a door-to-door approach was performed. Data were collected by 8 teams of 3 trained investigators, using a questionnaire adapted from WHO STEPS tools(10) in the households.

Sociodemographic data

Sociodemographic data included age, sex, marital status (never married, living with someone as a couple, widow/divorced/separated), education (none, primary education, higher), profession (employee/government employee, craftsman/ storekeeper, farmer/breeder/fisherman, homemade/retired, jobless), and the household income per month (low, middle, high) according to the World Bank indicators(11).

Cardiovascular risk factors

The cardiovascular risk factors were defined according to the WHO STEPS surveillance manual(12). Tobacco use was assessed and participants were classified as never users and current/former users (including cigarette, cigar, pipe or other modes of tobacco use including chewing tobacco).

Weight was measured to the nearest 100 g on mechanical scales (Seca, Hamburg, Germany) and height was measured to the nearest centimeter using a carpenter meter. While the stand upright position was impossible, height was estimated according to the knee height (KH) using Chumlea's formula for non-Hispanic Black people. Body mass index (BMI) was calculated as weight/height². Underweight was defined as BMI <18.5 kg/m², normal weight: BMI= 18.5-24.9 kg/m², overweight: BMI= 25-29.9 kg/m², and obese BMI ≥ 30 kg/m².

Diabetes was defined as currently taking antidiabetic drugs or having a fasting capillary whole blood glucose value³ 126 mg/dL(13).

Blood pressure measurements and HTN definition

Systolic (SBP) and diastolic (DBP) blood pressures at rest were recorded three times in both arms at 5-minutes intervals, using a electronic device (OMRON® M3, OMRON Corporation, Japan). In accordance to the 2017 ESC Guidelines on hypertension the average of the last two measurements was used in the analyses and hypertensive subjects was defined by self-reporting ongoing treatment, or SBP ³140 mm Hg and/or DBP ³90 mm Hg (14). The hypertension was defined as controlled when SBP <140 mm Hg and DBP <90 mm Hg under pharmacological treatment

Other Data

Nutritional variables included the dietary sodium intake using a food frequency questionnaire(15) and defined according to the WHO guidelines for sodium intake(16). Low intake of fruit and vegetable was defined as consuming less than five total servings (400 g) of fruit and vegetables per day.

Harmful use of alcohol was defined as consumption of >60 g of alcohol for men or 40 g for women in one occasion within the last 30 day.

Sedentary lifestyle was defined as <150 min of moderate-intensity activity (walk, bicycle) per week, or equivalent.

Data Analysis

Descriptive analyses were performed to compare the socio-demographic, cardiovascular risk factors and nutritional variables in men and women. The averages (±SD) and numbers (ratios) were compared with

Fisher's exact test and the Chi-square test, as appropriate.

The association between variables and HTN was assessed by univariate and multivariate analyses. A multivariate logistic regression model was performed to identify associated factors for HTN within demographic variables and CVD risk factors when p-value <0.20 in univariate logistic regression. Interactions between independent variables in the final model were examined.

We performed several models. In these models, age and sex were forced systematically.

First, we adjusted for sociodemographic factors such as age, sex, country, area, marital status, and previous occupation (model 1). Second, cardiovascular risk factors — tobacco use, BMI, physical activity, diabetes — were additionally adjusted (Model 2).

Third, nutritional factors (salt consumption and alcohol consumption, fruits a,d vegetables) were also adjusted for (Model 3).

The level of significance was fixed at 0.05 for all analyses. Statistical analyses were carried out using Statview.

Results

Study Population

Among the 1779 subjects aged 25 years and older who were approached, data for hypertension were missing for 2 participants, resulting in a total sample size of 1777 participants, mean age 42.5+16.5 years. Subjects who were 25– 34 years old comprised the largest group (41.0%). Females accounted for more than 60% of this population (Table 1).

The global prevalence of hypertension was 32.9% (584 subjects), with the prevalence of hypertension being similar in men and women (32.8% (228) and 33.0% (356) respectively). General characteristics of our study population are detailed in Table 1. The prevalence of hypertension increased significantly with age (OR: 1.04, p<0.001) (Table 2).

The univariate analysis indicated that increased age, the past or current use of tobacco, increased BMI, sedentary lifestyle, widowed or divorced status, previous occupation other than employee, lower education, animist religion, and increased salt consumption were associated with an increased likelihood of hypertension (Table 2). In the full model (model 3), increased age and BMI, homemade and retired status as well as animist religion remained significantly associated with an increased likelihood of hypertension, whereas the moderate alcohol consumption remained associated with a lower ratio of HTN (Table 2).

Further analyses suggested a higher likelihood of hypertension in the case of high to very high salt consumption and sedentary lifestyle in women as compared to men who seemed less exposed to HTN by a moderate alcohol intake (Table 3). Age, increasing BMI and animist religion remain significant associated HTN factors in both men and women.

Awareness, Treatment, and Control ratios of hypertension

Among hypertensive participants, less than one-half (41.8%) were aware of their condition (Figure 1). Awareness ratios differed between men and women (32.9% vs. 47.5%; *p*= 0.0039) (Figure 2) and was not influenced by age, education, profession, marital status or income. Female sex was the only associated factor with controlled HTN, independently of the education, occupation, income or marital status (Table 4).

Only 46.3% (113) of hypertensive participants declared receiving antihypertensive treatment at the time of the study (Figure 1). No difference in the prevalence of treatment was observed between men and women (37.3% vs. 50.3%, *p= 0.0610*), nor in uncontrolled hypertensive (34.1% vs. 35.7%, *p= 0.1520*). Treatment was not influenced by the socio-economic status.

Discussion

To our knowledge, this population-based study conducted following the STEPS method recommended by the WHO for screening and monitoring risk factors of noncommunicable diseases is the one of the large investigations in the past five years of the prevalence and associated factors of HTN in rural population in West Africa. The study on hypertension conducted in general population in Benin, conducted in 2008, showed an alarming prevalence of 27.9%(8). This condition was highly undiagnosed, as 78% of the subjects were unaware of their high blood pressure. As hypothesized, using the same methodology, our study underlines the highly increased HTN prevalence (32.9%) since 2008 (8). Also, previous data suggested a higher prevalence in urban areas compared to rural zones, explained by the fact that rural African populations were characterized by a traditional lifestyle associating cultural and dietary habits more in favour of HTN prevention (27.1% in rural areas vs 29.5% in urban zones in 2011) (17). Almost twenty years later, our study points out the sociocultural transition in rural areas with a prevalence of HNTN even higher than the prevalence described previously in urban areas. The prevalence of HTN observed in the present study is at the same level as that reported recently in other countries in sub-Saharan Africa: Ghana, Nigeria, South Africa, Sudan and Tanzania (18-20).

The factors generally found to be associated with hypertension include age, BMI, sedentary lifestyle, tobacco use, alcohol consumption. Most of these have previously been identified as important risk factors for hypertension by the different studies conducted in different parts of SSA(21-26). Our results also confirm some of these observed associations such as increasing age, sedentary lifestyle and BMI. The progressive aging of the population with the increase in life expectancy may partially explain the progression of HTN prevalence in Benin.

Our study observed that tobacco users, generally considered at higher risk of CVD were not at higher risk to be hypertensive. This result is probably due to the very low ratio of tobacco use in Benin. Also, alcohol consumption, a well-known risk factor of HTN (14) was not significantly reported in our analyses. In other sub-Saharan African studies results are also controversial, showing either association, or no significant association of HTN and moderate to heavy alcohol consumption(27, 28). Our study suggests a slightly protective effect of the light alcohol consumption in men, probably as the reflect of a healthy lifestyle. All

these studies are hardly comparable as they used different settings, and assessments of alcohol consumption.

Recent data show that salt consumption around the world is much higher than is physiologically necessary(29), even more in males than females at any age(30, 31). In a systematic review and meta-regression in 2016 no gender difference was reported in African studies(32). In our study, high salt intake, was independently associated with a higher likelihood of prevalent hypertension. Dietary estimates of sodium intake might not be accurate due to recall bias, reporting errors, erroneous food composition tables (especially if not country-specific or outdated), and/or difficulty in quantifying added salt (e.g. salt added during cooking but discarded in cooking water, etc). However, the fact that there might be a difference between men and women, suggests that context-specific research is needed to establish whether patterns of sodium intake in the SSA settings differ from high-income countries or other low- or middle-income countries.

Our finding regarding higher ratios of HTN in subjects of animist religion are intriguing and we do not find any rational. Further confirmatory and exploratory studies are needed.

In our study, less than 42% of hypertensive participants were aware of their pathology and less than one-half of them took antihypertensive treatments. Among treated subjects, only one-third had controlled hypertension. Few studies have analysed awareness and treatment ratios of hypertension, as well as the fraction with controlled hypertension in Africa(8, 26).

The ratios of awareness and controlled hypertension were higher than other studies on the continent. These differences might be related to variances in socioeconomic levels, healthcare access and preventive measures to reduce HTN. The findings of our study also suggest that independently of the socio-cultural status, women could be more receptive to treatment and more regular during the follow up. This could be explained by a better medical survey for women during and after pregnancy.

Our study has several limitations. Although the definition of hypertension respects the current guidelines, no ambulatory pressures were available. Furthermore, the cross-sectional design of the study, do not allow the assessment of the temporal nature of the associations and survival bias cannot be totally excluded. We also cannot exclude Recall bias cannot be excluded, especially for nutritional factors, but this it is limited since informants were interviewed alongside participants. Also, data on dyslipidaemia were not available and thus were not adjusted for in this study.

Conclusions

In terms of public health, this large population-based study confirms the high burden of HTN in sub-Saharan Africa and highlights the urgent need for HTN screening, treatment, and control the. Less than half of the population with hypertension are aware of their hypertension, indicating the burden of undiagnosed and un-controlled high blood pressure in these populations.(33) Future studies in the same setting would enable to assess the evolution of hypertension and its management in this specific setting.

Abbreviations

BMI: body mass index, CVDs: cardiovascular diseases, DBP: diastolic blood pressure, HTN: hypertension, KH: knee height, SBP:systolic blood pressure, SSA: sub-Sahara Africa, TAHES: TAnve HEalth Study

Declarations

Ethics approval and consent to participate

The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki. All participants and/or their families gave informed consent prior to inclusion in the study. Written consent was obtained whenever feasible. For illiterate people, the study's objectives were verbally explained and consent was obtained by thumbprint.

The study and it's consentment method had prior approval of the Benin National Health's Research Ethics Committee and the "Comité de Protection des Personnes du Sud-Ouest et d'Outre-Mer 4 in France".

Consent for publication

Not applicable

Availability of data and material

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

Authors I.D, S.A.A, Y.C.H, S.D.H, G.N.G, V.A, P.M.P, Ph.L, designed the study, directed its implementation, including quality assurance and control, and prepared its analytic strategy. Authors S.A.A, Y.C.H, S.D.H, G.N.G, V.A, P.M.P helped conduct the literature review an prepare the Methods and the Discussion sections of the text. Authors I.D and S.A.A did the statistical analysis and drafted the manuscript. Author V.A was a major contributor in writing the manuscript. All authors read and approved the final manuscript.

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Authors' information

Authors I.D, S.A.A, S.D.H, V.A, P.M.P, Ph.L, members of the Research team INSERM 1094 are actively implicated in epidemiological research of non-communicable diseases in tropical countries, with a particular focus on cardiovascular risk factors in Africa.

Authors I.D and V.A actively participated at the 2018 European Society of Cardiology/European Society of Hypertension Guidelines for the management of arterial hypertension, as members of the ESC/ESH Task Force.

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Tables

Table 1. Characteristics of study participants:

	Total Population	Men	Women	*p*
	n (%)	n (%)	n (%)	Men vs. Women
Total sample size	1777	695 (39.1)	1082 (60.9)	*0.2732*
Sociodemographic variables				
Age (y)	42.5±16.5	43±16.8	42.1±16.4	*0.2732*
Marital status				*<0.0001*
Married/in couple	1336 (75.2)	554 (79.7)	782 (72.3)	
Single	213 (12.0)	116 (16.4)	97 (9.0)	
Widowed/divorced/separated	228 (12.8)	25 (3.6)	203 (18.7)	
Education				*<0.0001*
None	1175 (66.1)	348 (50.1)	827 (76.4)	
Primary	406 (22.9)	216 (31.1)	190 (17.6)	
Higher	196 (11.0)	131 (18.8)	65 (6.0)	
Occupation				*<0.0001*
Farmer/breeder/fisherman	337 (18.9)	181 (26.0)	156 (14.4)	
Craftsman/storekeeper	1170 (65.8)	385 (55.4)	785 (72.6)	
Employee/government employee	130 (7.3)	93 (13.4)	37 (3.4)	
Homemade/retired	50 (2.8)	6 (0.9)	44 (4.1)	
Jobless	90 (5.1)	30 (4.3)	60 (5.5)	
Religion*				*<0.0001*
Christians	1009 (61.6)	374 (56.4)	635 (65.1)	
Animists	529 (32.3)	254 (38.3)	275 (28.2)	
Other	101 (6.2)	35 (5.3)	66 (6.7)	
Average household income / month				
Low	1011 (56.9)	237 (34.1)	774 (71.5)	*<0.0001*
Middle	748 (42.1)	447 (64.3)	301 (27.8)	
High	18 (1.0)	11 (1.6)	7 (0.7)	
Depression	171 (9.7)	54 (7.8)	117 (10.8)	*0.0400*
Anxiety	249 (14.0)	63 (9.1)	186 (17.2)	*<0.0001*
Cardiovascular risk factors				
Body mass index: kg/m²				*<0.0001*
<18.5	210 (11.9)	97 (14.0)	114 (10.5)	
18.5-25	1032 (58.3)	436 (63.0)	595 (55.1)	
25-30	374 (21.1)	129 (18.6)	245 (22.7)	
≥30	155 (8.7)	30 (4.4)	125 (11.7)	

Tobacco use	152 (8.6)	93 (13.4)	59 (5.5)	*<0.0001*
Smoked tobacco	100 (5.6)	78 (11.2)	22 (2.0)	*<0.0001*
Chewed tobacco	76 (4.9)	29 (4.2)	47 (4.3)	*0.0658*
Diabetes**	55 (3.1)	21 (3.1)	34 (3.2)	*0.9168*
Physical activity <150 min/week	1037(58.4)	394 (56.7)	643 (59.4)	*0,2182*
Hypertension	584 (32.9)	228 (32.8)	356 (33.0)	*0.9342*
Nutritional variables				
Fruits and vegetables <5/day	1603 (90.2)	618 (88.9)	985 (91.0)	*0.1512*
Alcohol consumption				*<0.0001*
Abstainers	847 (47.7)	196 (28.2)	651 (60.2)	
Light	513 (28.9)	200 (28.8)	310 (28.7)	
Moderate to heavy	417 (23.5)	299 (43.0)	118 (10.9)	
Salt intake (often or very often)***	1029 (58.6)	344 (49.7)	685 (63.3)	*<0.0001*

Table 2. Factors associated with hypertension

Factors	Univariate analysis		Multivariate analysis					
			Model 1*		Model 2*		Model 3*	
	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*
Age (y)	1.04 (1.03-1.04)	*<0.0001*	1.04 (1.03-1.05)	*<0.0001*	1.04 (1.03-1.05)	*<0.0001*	1.04 (1.03-1.05)	*<0.0001*
Sex								
Males	1		1		1		1	
Females	1.00 (0.82-1.23)	*0.9558*	1.07 (0.83-1.38)	*0.5977*	0.94 (0.72-1.22)	*0.6305*	1.01 (0.77-1.33)	*0.9460*
Education								
None	1		1		1		1	
Primary	0.59 (0.46-0.76)	*<0.0001*	0.95 (0.71-1.27)	*0.7203*	0.92 (0.68-1.24)	*0.5762*	0.89 (0.66-1.22)	*0.4908*
Higher	0.72 (0.52-1)	*0.0541*	0.70 (0.93-2.28)	*0.1024*	0.81 (0.83-2.12)	*0.2345*	0.80 (0.86-2.19)	*0.1896*
Occupation								
Employee/government employee	1		1		1		1	
Craftsman/storekeeper	1.38 (0.90-2.12)	*0.1356*	1.37(0.80-2.34)	*0.2478*	1.29 (0.75-2.24)	*0.3564*		*0.3987*
Farmer/breeder/fisherman	2.2 (1.38-3.49)	*0.0008*	1.44 (0.80-2.59)	*0.2216*	1.56 (0.85-2.84)	*0.1501*	1.49(0.81-2.72)	*0.1971*
Homemade/retired	2.84 (1.42-5.66)	*0.0030*	2.31 (1.02-5.22)	*0.0451*	2.79 (1.19-6.53)	*0.0173*	2.81 (1.19-6.67)	*0.0190*
Jobless	5.00 (2.78-8.99)	*<0.0001*	1.52 (0.72-3.20)	*0.2736*	1.73 (0.81-3.70)	*0.1578*	1.61 (0.75-3.46)	*0.2222*
Religion								
Christians	1		1		1			

Animists	1.97 (1.58-2.46)	*<0.0001*	1.43 (1.12-1.82)	*0.0042*	1.57 (1.22-2.02)	*0.0005*	1.52 (1.17-2.62)	*0.0048*
Other	1.22 (0.78-1.89)	*0.3815*	1.06 (0.67-1.69)	*0.8021*	1.12 (0.68-1.77)	*0.6934*	1.16 (0.58-1.89)	0.7834
Marital status								
Single	1		1					
Married/in couple	1 (0.73-1.38)	*0.9621*	0.89 (0.63-1.26)	*0.5102*				
Widowed/divorced/separated	2.84 (1.92-4.21)	*<0.0001*	1.10 (0.69-1.77)	*0.6800*				
Average household income/month								
Low	1							
Middle	0.97 (0.81-1.21)	*0.8896*						
High	0.78 (0.27-2.20)	*0.6368*						
Depression								
No	1							
Yes	1.1 (0.79-1.53)	*0.5790*						
Anxiety								
No	1		1					
Yes	1.21 (0.91-1.59)	*0.1895*	0.97 (0.71-1.33)	*0.8536*				
Body mass index (kg/m²)								
18.5-25	1				1		1	
<18.5	1.48	*0.0141*			1.05	*0.7940*	1 (0.7-	*0.9598*

	(1.08-2.03)		(0.73-1.51)		1.46)	
25-30	1.92 (1.50-2.46)	*<0.0001*	2.12 (1.60-2.79)	*<0.0001*	2.10 (1.59-2.18)	*<0.0001*
≥30	2.78 (1.97-3.92)	*<0.0001*	3.57 (2.43-5.25)	*<0.0001*	3.32 (2.25-4.89)	*<0.0001*
Tobacco Use (smoked/chewed)			0.84 (0.57-1.26)	*0.4021*		
No	1					
Yes (past/current)	1.54 (1.10-2.17)	*0.0119*				
Diabetes						
No	1					
Yes	1.09 (0.62-1.93)	*0.7533*				
Physical activity						
≥150 min/week	1		1		1	
<150 min/week	1.37 (1.11-1.67)	*0.0027*	1.17 (0.93-1.48)	*0.1755*	1.18 (0.93-1.49)	*0.1725*
Fruits and vegetables						
≥5/day	1					
<5/day	1.03 (0.74-1.45)	*0.8363*				
Alcohol consumption						
Abstainers	1				1	
Light	0.77 (0.60-0.98)	*0.0313*			0.75 (0.57-0.99)	*0.0500*
Moderate to heavy	1.19 (0.94-1.53)	*0.1487*			1.11 (0.82-1.50)	*0.5162*
Salt consumption						

Rarely	1			1	
Often and very often	1.23 (1-1.50)	*0.0512*		1.11 (0.89-1.41)	*0.3801*

**Model 1: adjusted for demographic and socio-economic factors*

***Model 2: adjusted for demographic, socio-economic and cardiovascular risk factors*

****Model 3: adjusted for demographic, socio-economic, cardiovascular risk factors and nutritional factors*

Table 3. Factors associated with hypertension in male and female population

Factors	FEMALES		MALES	
	Multivariate analysis*			
	OR (95% CI)	*p*	OR (95% CI)	*p*
Age (y)	1.05 (1.04-1.06)	***<0.0001***	1.03 (1.01-1.04)	***<0.0001***
Marital status				
Single	1		1	
Married/in couple	0.92 (0.54-1.55)	*0.7499*	0.86 (0.52-1.45)	*0.5752*
Widowed/divorced/separated	0.98 (0.52-1.85)	*0.9547*	1.38 (0.50-3.81)	*0.5280*
Education				
None	1		1	
Primary	0.87 (0.56-1.37)	*0.5583*	0.91 (0.59-1.41)	*0.6763*
Higher	1.32 (0.58-3.00)	*0.5038*	1.21 (0.65-2.34)	*0.5519*
Occupation				
Employee/government employee	1		1	
Craftsman/storekeeper	0.98 (0.33-2.93)	*0.9745*	1.21 (0.63-2.34)	*0.5706*
Farmer/breeder/fisherman	1.30 (0.41-4.16)	*0.6550*	1.37 (0.64-2.90)	*0.4169*
Homemade/retired	2.06 (0.55-7.73)	*0.2895*	7.19 (0.75-69.29)	*0.0876*
Jobless	1.46 (0.40-5.34)	*0.5638*	0.85 (0.26-0.74)	*0.7804*
Religion				
Christians	1		1	
Animists	1.52 (1.06-2.16)	***0.0211***	1.75 (1.17-2.62)	***0.0068***
Other	0.94 (0.51-1.73)	*0.8408*	1.72 (0.76-3.89)	*0.1921*
Depression				
No	1		1	
Yes	1.94 (0.54-1.66)	*0.8444*	1.55 (2.56-1.19)	*0.1277*
Anxiety				
No	1		1	
Yes	0.87 (0.57-1.40)	*0.5789*	1.77 (0.91-3.42)	*0.0922*
Body mass index (kg/m²)				
18.5-25	1			
<18.5	0.56 (0.31-0.99)	*0.0482*	1.29 (0.75-2.22)	*0.3593*
25-30	2.16 (1.49-3.12)	***<0.0001***	1.89 (1.19-3.02)	***0.0069***
≥30	3.02 (1.89-4.81)	***<0.0001***	5.28 (2.36-11.77)	***<0.0001***
Tobacco				
No	1			
Yes	0.75 (0.39-1.46)	*0.4032*	0.83 (0.57-1.19)	*0.4916*
Diabetes				
No	1		1	

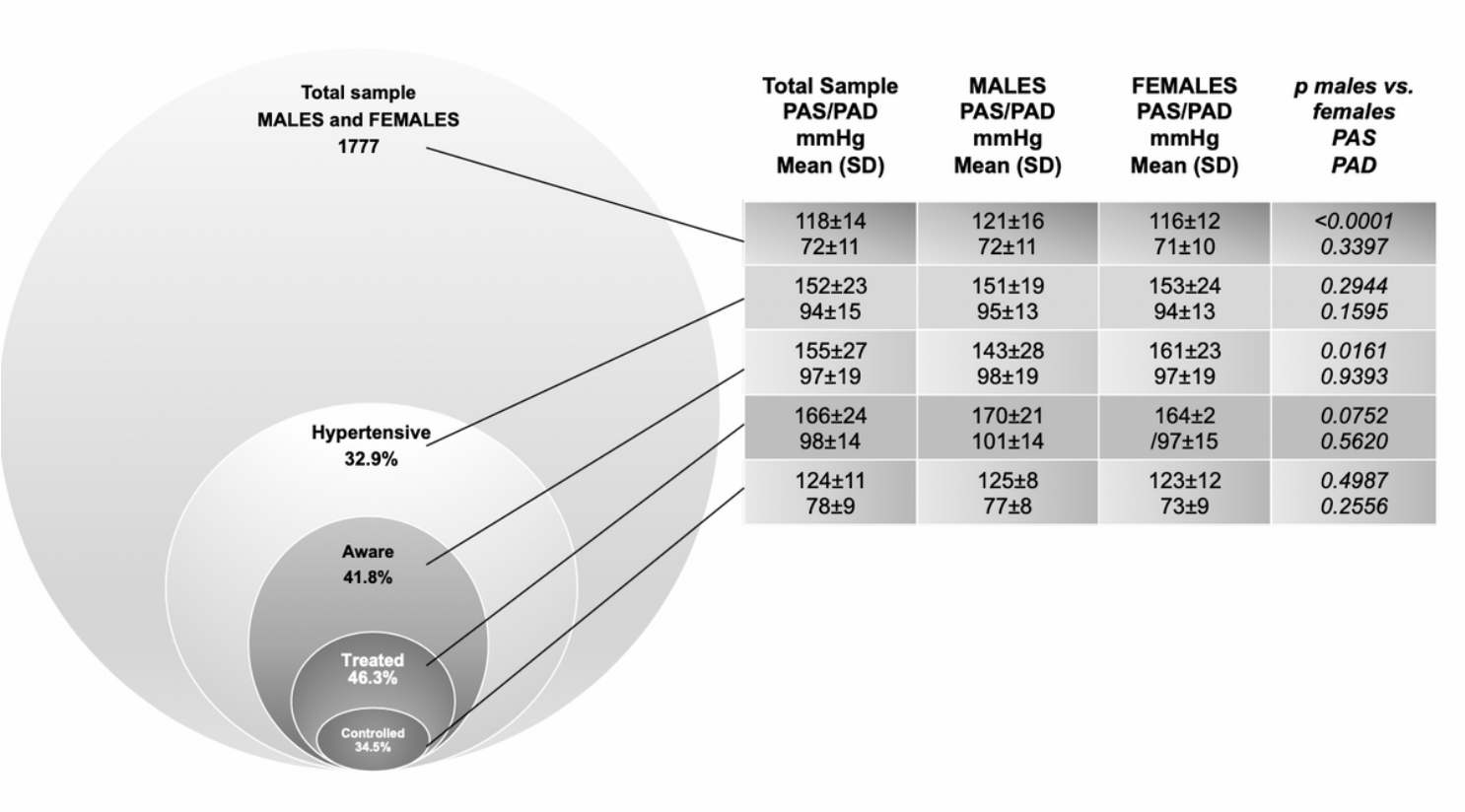
	Yes	0.83 (0.34-2.00)	*0.6723*	1.43 (0.53-3.86)	*0.4761*
Physical activity					
	≥150 min/week	1		1	
	<150 min/week	1.44 (1.05-1.95)	***0.0245***	0.99 (0.68-1.44)	*0.9520*
	≥5/day	1		1	
	<5/day	0.95 (0.55-1.65)	*0.8567*	1.13 (0.61-2.10)	*0.6993*
Alcohol consumption					
	Abstainers	1		1	
	Light	0.73 (0.51-1.04)	*0.0838*	0.74 (0.45-0.98)	***0.0467***
	Moderate to heavy	1.05 (0.64-1.73)	*0.6723*	1.14 (0.73-1.78)	*0.5732*
Salt consumption					
	Rarely	1		1	
	Often or very often	1.42 (1.02-1.97)	***0.0365***	0.83 (0.57-1.20)	*0.3168*

**Adjusted for demographic and socio-economic, cardiovascular risk factors and nutritional factors*

Table 4. Factors associated with controlled hypertension

Factors	Multivariate analysis	
	OR (95% CI)	*p*
Age (y)	0.98 (0.96-1.01)	*0.2992*
Sex		
Males	1	
Females	2.90 (1.11-5.57)	***0.0296***
Education		
None	1	
Primary	0.57 (0.18-1.79)	*0.3358*
Higher	1.39 (0.37-5.2)	*0.6273*
Occupation		
Employee/government employee	1	
Craftsman/storekeeper	0.67 (0.14-3.18)	*0.6177*
Farmer/breeder/fisherman	0.54 (0.09-3.36)	*0.5103*
Homemade/retired	0.54 (0.05-6.69)	*0.6279*
Jobless	0.40 (0.03-5.90)	*0.5040*
Religion		
Christians	1	
Animists	0.90 (0.38-2.10)	*0.7997*
Other	1.81 (0.47-7.01)	*0.3886*
Marital status		
Single	1	
Married/in couple	1.14 (0.36-3.60)	*0.8216*
Widowed/divorced/separated	0.43 (0.08-2.31)	*0.3197*
Average household income/month		
Low	1	
Middle/high	1.24 (0.56-2.73)	*0.5899*

Figures



Total Sample PAS/PAD mmHg Mean (SD)	MALES PAS/PAD mmHg Mean (SD)	FEMALES PAS/PAD mmHg Mean (SD)	*p males vs. females* *PAS* *PAD*
118±14 72±11	121±16 72±11	116±12 71±10	*<0.0001* *0.3397*
152±23 94±15	151±19 95±13	153±24 94±13	*0.2944* *0.1595*
155±27 97±19	143±28 98±19	161±23 97±19	*0.0161* *0.9393*
166±24 98±14	170±21 101±14	164±2 /97±15	*0.0752* *0.5620*
124±11 78±9	125±8 77±8	123±12 73±9	*0.4987* *0.2556*

Figure 1

Venn diagram representing the prevalence and the proportions of awareness, treatment and controlled hypertension in study population. For each category, values of systolic (SBP) and diastolic (DBP) blood pressures in both sexes.

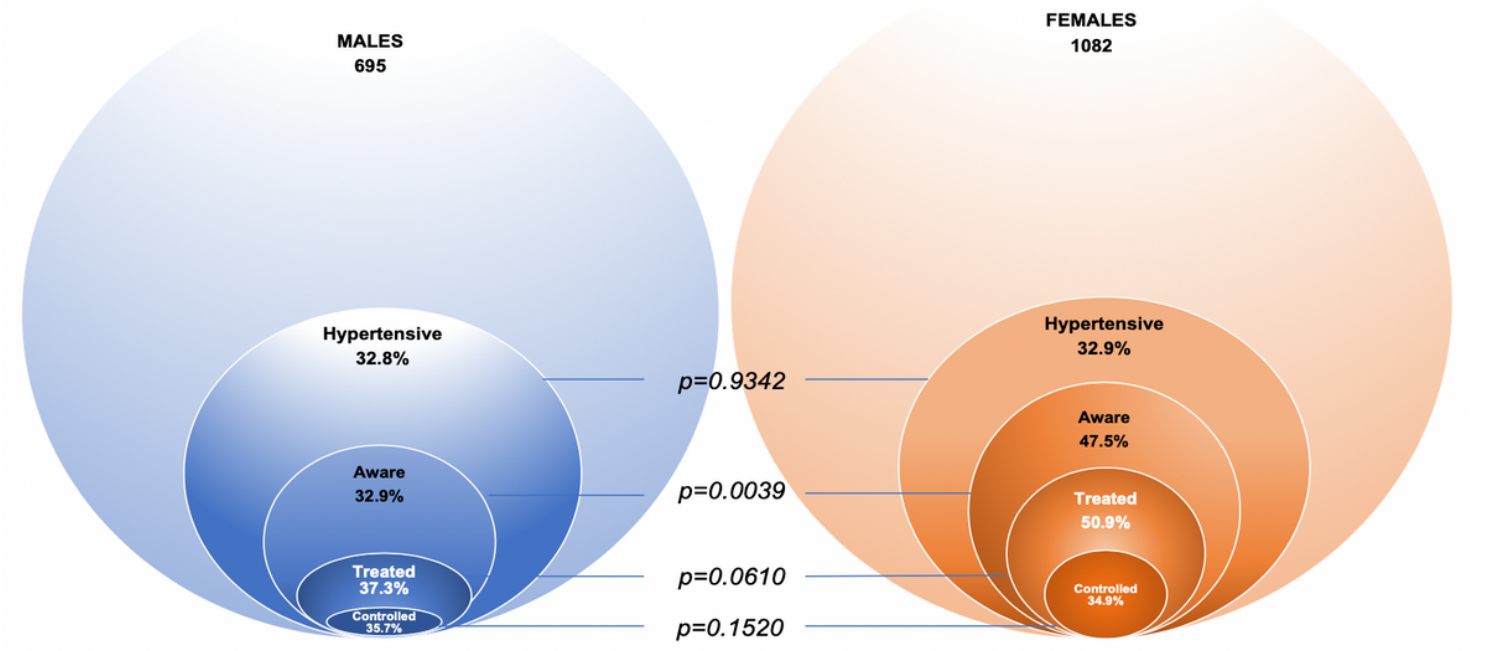


Figure 2

Venn diagrams representing the prevalence and the proportions of awareness, treatment and controlled hypertension in males and females