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Prevalence of hypertension and associated risk factors in Benin☆

Prévalence de l'hypertension artérielle et facteurs de risque associés en population générale au Bénin

D.S. Houinato [a,*,b], A.R. Gbary [a,c], Y.C. Houehanou [b], F. Djrolo [a], M. Amoussou [a], J. Segnon-Agueh [b], A. Kpozehouen [a,d], R. Salamon [d]

[a] *Université d'Abomey Calavi, 01 BP 526, Cotonou, Bénin*
[b] *Programme national de lutte contre les maladies non transmissibles, ministère de la Santé, 01 BP 882 Cotonou, Bénin*
[c] *Bureau de représentation de l'Organisation mondiale de la santé, BP 918, Cotonou, Bénin*
[d] *Institut de santé publique, d'épidémiologie et de développement (ISPED), université de Bordeaux-2, Case 11-146, 33076 Bordeaux, France*

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Abstract

Background. – Hypertension is one of the main risk factors of cardiovascular diseases. There has been a lack of data on this risk factor in the general population in Benin. The aim of this study was to determine the prevalence of hypertension and identify the associated risk factors in Benin.

Methods. – A cross-sectional study was conducted from July to August 2008 in Benin's 12 departments. The questionnaire and anthropometric measurements of the World Health Organization STEPWISE survey were used. The sample included 6853 subjects 25–64 years of age, randomly selected by five-stage random sampling. Blood pressure was measured using standard procedures. Data was processed and analyzed using EPI DATA and STATA 9.2 software. Prevalence levels were compared using Pearson's chi^2 and means with the Student *t*-test. Univariate and multivariate regression analysis, taking the sampling method into account, was used to identify risk factors.

Results. – The sample comprised 49.5% females, the 25- to 34-year-old age group was the largest, and the mean age was 42.7 ± 12.4 years. The prevalence of hypertension was 27.9% [95% CI: 26.3–29.5%], 77.5% of the subjects were unaware of their high blood pressure, and 81.6% had not taken their drugs two weeks before the survey. Prevalence of known hypertension was 6.9%, prevalence of treated hypertension 4.8%, and prevalence of controlled hypertension 1.9%. Age and obesity were significantly associated with hypertension. Department and profession were not associated with hypertension.

Conclusion. – This study showed a high prevalence of hypertension in the general population in Benin. Better management of this risk factor will contribute to reducing morbidity and mortality due to cardiovascular diseases.

Keywords: Prevalence; Hypertension; Noncommunicable diseases; Benin

Résumé

Position du problème. – L'hypertension artérielle (HTA) est l'un des principaux facteurs de risque de maladies cardiovasculaires. L'objectif de ce travail est de déterminer la prévalence de l'HTA en population générale au Bénin en 2008 et d'identifier ses facteurs de risque.

Patients et méthodes. – Il s'agit d'une étude transversale qui s'est déroulée de juillet à août 2008 dans les 12 départements du Bénin. La méthode d'enquête STEPWISE de l'Organisation mondiale de la santé a été utilisée. L'étude a porté sur 6853 personnes, âgées de 25 à 64 ans sélectionnées par sondage aléatoire à cinq degrés. La pression artérielle a été mesurée selon les procédures standards. Les données ont été saisies à l'aide de EPI DATA et analysées par STATA 9.2. Les prévalences ont été comparées par le Khi^2 de Pearson et les moyennes par le test *t* de Student. Une régression logistique prenant en compte le schéma d'échantillonnage a été utilisée pour identifier les facteurs de risque.

Résultats. – La tranche d'âge de 25–34 ans était la plus représentée et l'âge moyen (écart-type) était de 42,7 ± 12,4 ans et il y avait 49,5 % de femmes. La prévalence de l'HTA était de 27,9 % [IC 95 % : 26,3–29,5 %], 77,5 % des hypertendus ignoraient qu'ils avaient une pression artérielle élevée et 81,6 % des patients sous traitement n'avaient pas pris leurs médicaments dans les deux semaines précédant l'enquête. La prévalence de

☆ Study conducted within the National Noncommunicable Disease Control Program (Programme national de lutte contre les maladies non transmissibles [PNLMNT]) of the Benin Health Ministry in partnership with the World Health Organization (WHO).

* Corresponding author.
E-mail address: dshouinato@yahoo.fr, dshouinato@gmail.com (D.S. Houinato).

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l'HTA connue était de 6,9 %, celle de l'HTA traitée de 4,8 % et celle de l'HTA contrôlée de 1,9 %. L'âge et l'obésité étaient significativement associés à l'HTA. Le département de résidence et la profession n'étaient pas associés avec la survenue de l'HTA.

Conclusion. – Cette étude indique l'importance de la prévalence de l'HTA en population générale au Bénin. Une meilleure prise en charge de ce facteur de risque contribuera à réduire la morbidité et la mortalité dues aux maladies cardiovasculaires.

Mots clés : Prevalence ; Hypertension ; Maladies non transmissibles ; Bénin

1. Introduction

More than one-quarter of the world adult population has hypertension (HTN), expected to reach 29% by 2025, i.e., nearly 1.6 billion hypertensive subjects in the world [1]. HTN is one of the main cardiovascular risk factors in terms of cardiovascular mortality and morbidity [2]. Of 17 million patients who die every year of cardiovascular diseases, seven to eight million are estimated to be hypertensive [3]. The prevalence of HTN is gradually increasing in the world because of the aging of the population as well as the increase in the proportion of obese or overweight subjects [4,5]. It is estimated that in 2025 nearly three-quarters of the hypertensive population will be living in developing countries because of massive urbanization [6,7]. HTN involves approximately 20 million people in Africa and its prevalence varies widely, between 20 and 30% [8–13]. Continuing to carry the burdensome weight of infectious diseases, over the past few decades, Africa has been confronted with an explosion of noncommunicable diseases as well.

Benin has not been spared, in view of the partial data available [14]. In terms of risk factors, the expression ''high blood pressure'' (HBP) is recommended and the 2002 report on health in the world identified it as one of the eight main risk factors of noncommunicable diseases [3]. The lack of national studies on this risk factor and the absence of a monitoring system designed for noncommunicable diseases in this country have motivated this study.

The objective of this study was to determine the prevalence of hypertension in Benin in 2008 and to identify the associated risk factors.

2. Materials and methods

2.1. Study description

Located in Western Africa on the Gulf of Guinea between 6 and 12 degrees north, Benin covers a surface area of 114,763 km^2. Its population was estimated at 8,364,942 inhabitants in 2008 based on projections of the 2002 census [15]. Children under 15 years of age comprise 49% of the population. Life expectancy at birth is 59.2 years. Benin is composed of 12 administrative departments, 77 towns, and 546 arrondissements subdivided into neighborhoods/villages. Its main economic activities are agriculture, the craft industry, and informal trade. The per capita Gross Domestic Product is 314,000 FCFA, or 479.4 €. Communicable diseases such as malaria, acute respiratory infections, and diarrhoea are the main causes of morbidity and mortality. The healthcare system is organized based on the model of primary healthcare with a central level, an intermediate level, and a peripheral level encompassing all healthcare programs.

2.2. Study design and study population

This study was a cross-sectional, descriptive, and analytical. The target population was made up of adults, 25–64 years of age, living in Benin for at least six months before the date of the survey. Those who could not undergo questioning and pregnant women were not included in the study.

Written consent was obtained from the participants selected before the survey. Authorization was obtained from both the Benin health authorities and the national healthcare ethics committee before the study began.

2.3. Sampling technique

The study was conducted using a randomized five-stage sampling frame. Sixty arrondissements were randomly selected in proportion to the size of the population according to the method proposed by the World Health Organization (WHO) [16]. In each of the arrondissements retained, the list of neighborhoods or villages was drawn up and half was selected. In each neighborhood retained, the dwellings, households, and then the individuals were randomly chosen as follows: the investigator was placed in the center of the neighborhood or village and randomly chose a direction. In this chosen direction, he entered one out of two dwellings. In the dwellings retained, he made a list of the households and randomly selected one out of two of them. Within the household, the subject to be interviewed was identified using the Kish method [17]. This procedure was followed until the predetermined sample was obtained for the neighborhood or village retained. The Kish method offers the advantage of equiprobable selection of individuals and takes sex and age into account.

2.4. Sample size

The sample size was determined by selecting a 1.5% precision level, a 5% type I error level, and a theoretical HTN prevalence level of 27.8% [14]. It was multiplied by two considering that an arrondissement corresponded to a cluster of individuals and selecting a cluster effect of 2.

A total of 6660 individuals were needed, 111 (6660/60) per arrondissement. The number of individuals to survey per neighborhood or village selected was determined proportionally to the size of the population.

2.5. Data collection

The data were collected from 1 July to 24 August 2008. A structured interview was conducted by the investigator with the subject surveyed at the latter's home. A questionnaire was used to collect the sociodemographic data such as age, sex, profession, sociocultural milieu, level of education, the residential environment, history of HTN, and current anti-hypertension treatment [16]. Weight and height were then measured. Weight was measured within 100 g with an electronic scale; height was measured with a height gauge calibrated every 0.1 cm. Blood pressure was measured in the seated position, after the patient had rested for 15 min, by a licensed nurse or a medical student using an OMRON electronic blood pressure monitor with a cuff. Three measurements were taken at 5-min intervals; the mean of the last two measurements was used to define blood pressure. Urban or rural residence was defined according to Benin's Statistical and Economic Analysis Institute's (INSAE) list. The definition of urban zones was based on the following criteria: the size of the population at least equal to 10,000 inhabitants, the presence of at least four of the following infrastructures: a post office, an electricity network, a drinking water supply network, a middle/high school, a bank, and a town hall bureau [15].

The operational definitions of HTN were given in accordance with the survey context. HBP was defined as systolic blood pressure greater than or equal to 140 mmHg and/or diastolic blood pressure greater than or equal to 90 mmHg. The following subjects were classified as hypertensive: subjects who had HBP on the day of the survey and known hypertensives with a normal blood pressure on the day of the survey. Of the known hypertensives, those receiving specific antihypertension treatment or on a specific diet at the time of the survey were classified as ''treated HTN.'' Of these subjects, those who had normal blood pressure on the day of the survey were classified as ''controlled HTN.'' The body mass index (BMI) was calculated by dividing the weight in kilograms by the height in square meters. Body status was classified into four categories according to the WHO norms [18]. Using these norms, those considered underweight had a BMI lower than 18.5 kg/m^2; those considered normal had a BMI equal to 18.5 kg/m^2 and less than 25 kg/m^2; those considered overweight had a BMI equal to 25 kg/m^2 and less than 30 kg/m^2; and those considered obese had a BMI equal to or greater than 30 kg/m^2.

2.6. Data analysis

Double data entry was used with EPI DATA software. Weighted data analysis was performed using STATA 9.2 software. The 95% confidence intervals (CI) around the estimation of prevalences were calculated using the method described by Bennett et al. [19] and the means were estimated with their standard deviations. The Pearson chi-square statistic was used to compare prevalences according to the socio-economic factors. The means were compared using the Student *t*-test or variance analysis. The factors associated with HTN in univariate analysis at the 20% threshold were introduced into the multivariate logistical regression model to search for HTN risk factors. The difference was statistically significant with a *p*-value less than 0.05. The potential age–profession interaction was tested but was not significant. It has been demonstrated that analyzing a multiphase random sample as a simple random sample could bias the results [20]. The analysis was therefore carried out taking the survey design into account.

3. Results

3.1. Description of the sample

A total of 6853 individuals, 25–64 years of age, were included in the sample, taking into account that in order to complete each cluster, all the eligible subjects in the last household were interviewed. Within this sample, 6786 answered all the questions, for a 99% response rate. Females accounted for 49.5% of this population. Subjects who were 25–34 years old comprised the largest group: 31.5% (Table 1). The

Table 1
Distribution of subjects by age group and residence environment, level of education, and body mass index; STEPS survey, Benin 2008.

Sociodemographic factors	Total numbers	Age group (years)				
	n	25–34 %	35–44 %	45–54 %	55–64 %	*p*
Residence						<0.0001
Rural	4483	28.5	24.1	17.1	30.3	
Urban	2302	37.4	24.3	16.6	21.6	
Level of education						<0.0001
None	4227	25.5	21.4	17.4	35.7	
Primary	1728	38.8	29.2	16.4	15.5	
Secondary	659	43.7	30.4	17.2	8.8	
University	166	59.9	16.8	10.2	13.2	
Body mass index (BMI: kg/m^2)						<0.0001
Normal	4333	35.6	23.3	15.1	26.3	
Underweight	449	21.8	15.9	18.5	43.8	
Overweight	1375	27.3	26.7	19.4	26.6	
Obese	629	19.7	30.6	23.3	26.3	

Table 2
Distribution of subjects by past history of hypertension, residence, age group, and level of education: STEPS survey, Benin 2008.

Sociodemographic factors	Number of subjects	Hypertension					
	n	Known		Treated		Controlled	
		%	*p*	%	*p*	%	*p*
Residence			<0.0001		0.0003		0.0175
Rural	4483	5.6		3.8		1.6	
Urban	2302	9.4		6.7		2.6	
Age group (years)			<0.0001		<0.0001		0.7574
25–34	2154	3.3		1.6		2.2	
35–44	1649	5.8		3.7		1.8	
45–54	1156	9.5		6.9		1.9	
55–64	1879	10.5		8.1		1.7	
Level of education			0.0023		0.0148		0.0027
None	4227	5.9		4.1		1.5	
Primary	1728	8.2		5.7		2.4	
Secondary	659	9.4		6.5		3.3	
University	166	9.6		7.2		3.6	
Number of subjects n (%)	6786 –100	469 (6.9)		327 –4.8		131 –1.9	

mean age (± standard deviation) was 42.7 ± 12.4 years. The proportions of subjects by age group differed depending on the residential environment ($p < 0.0001$). The largest age group in the urban environment was the 25- to 34-year-old age group (37.4%), whereas in the rural environment the 55- to 64-year old age group was the largest (30.3%) (Table 1).

Two subjects out of three (66.7%) lived in a rural environment. More than three subjects out of five (62.3%) had no education and only 2.5% of the subjects had a university-level education. The proportion of illiterate individuals was significantly higher in the 55- to 64-year-old age group ($p < 0.001$). The Atlantique department, which included the capital city Cotonou, had the greatest number of surveyed individuals (13%).

As for body status, 63.9% [95% CI (62.5%–64.8%)] of the subjects had a normal weight, 6.6% [95% CI (6.1%–7.3%)] were underweight, 20.3% [95% CI (19.3%–21.2%)] were overweight, and 9.3% [95% CI (8.7%–10.1)] were obese (Table 1). The proportion of obese individuals was significantly higher in women (14.1%) than in men (4.5%) ($p < 0.0001$). It was significantly higher in the 35–44 year-old group ($p < 0.0001$). The proportion of underweight persons was significantly greater in the 55–64 year-old group than in the other age groups ($p < 0.0001$). The mean BMI in females (24.5 ± 0.2 kg/m^2) was significantly higher than in males (22.8 ± 0.1 kg/m^2) ($p < 0.0001$). It was significantly higher in urban areas (25.3 ± 0.2 kg/m^2) than in rural areas (22.8 ±0.1 kg/m^2) ($p < 0.0001$).

The mean systolic blood pressure was significantly higher in males (130.3 ± 1 mmHg) compared to females (127.5 ± 1.2 mmHg) ($p < 0.0001$). The mean systolic blood pressure was not significantly different between urban (129.2 ± 0.6 mmHg) and rural environments (128.8 ± 0.8 mmHg) ($p = 0.6018$). The mean diastolic blood pressure in males (79.2 ± 0.7 mmHg) and in females (79.2 ± 0.7 mmHg) was not significantly different ($p = 0.9850$). The mean diastolic blood pressure was significantly higher in urban setting (80.1 ± 0.4 mmHg) than in rural areas (78.75 ± 0.6 mmHg) ($p = 0.0237$).

3.2. Prevalence of HTN and associated risk factors

The prevalence of HTN was 27.9% [95% CI (26.3%–29.5%)]. Nearly one-third of the 1894 hypertensive subjects (30.6%) declared that their blood pressure had been under control for more than 1 year and 77.5% of the subjects interviewed were not aware that they had HBP. The sample included 6.9% [95% CI (6.0%–7.8%)] individuals with known HTN, 4.8% [95% CI (4.1%–5.6%)] with treated HTN, and 1.9% [95% CI (1.8%–2.1%)] with controlled HTN. Of the 327 hypertensive subjects on treatment, 81.6% had not followed their treatment in the 2 weeks preceding the survey. Table 2 shows the results of the analysis of this subgroup. The prevalence of known HTN was significantly higher in urban areas ($p < 0.0001$), in individuals 55–64 years of age ($p < 0.0001$), and in persons with a university level education ($p = 0.0023$). Similarly, the prevalence of treated HTN was significantly higher in the urban areas ($p = 0.0003$), in those 55–64 years of age ($p < 0.0001$), and in those with a university education ($p = 0.0148$). The prevalence of controlled HTN was significantly higher in the urban setting ($p = 0.0175$) and in people with a university education ($p = 0.0027$). However, the prevalence of controlled HTN according to age group was not significantly different ($p = 0.7574$).

In the univariate analysis (Table 3), sex ($p = 0.7664$), education level ($p = 0.4410$), and residential environment ($p = 0.1562$) did not influence HTN. On the other hand, considering the 25- to 34-year-old age group as the reference, the risk of HTN was significantly higher in the 35- to 44-year-old (OR = 2.20; $p < 0.0001$), 45- to 54-year-old (OR = 3.86; $p < 0.0001$), and the 55-64-year-old (OR = 5.76; $p = 0.0001$) age groups. Obese people were more at risk for HTN

Table 3
Distribution of odds ratios of hypertension (HTN) factors in univariate analysis; STEPS survey, Benin 2008.

Factors	Total	HTN	Crude OR	95% CI		
	n (%)	*n* (%)				*p*
Sex						0.766
Male	3426 (50.5)	962 (28.8)	1			
Female	3360 (49.5)	932 (27.7)	0.98	0.88	1.10	
Age group (years)						<0.0001
25–34	2140 (31.5)	265 (12.4)	1			
35–44	1640 (24.2)	390 (23.8)	2.2	1.85	2.63	
45–54	1147 (16.9)	405 (35.3)	3.86	3.30	4.60	
55–64	1858 (27.4)	834 (44.9)	5.76	4.90	6.80	
Level of education						0.382
None	4227 (62.3)	1185 (28.3)	1			
Primary	1728 (25.5)	499 (28.9)	1.04	0.90	1.20	
Secondary	659 (9.7)	169 (25.6)	0.9	0.72	1.10	
University	166 (2.5)	41 (24.7)	0.84	0.57	1.24	
Departments						<0.0001
Atacora	568 (8.4)	129 (22.7)	1			
Alibori	458 (6.8)	109 (23.8)	1.06	0.71	1.59	
Atlantique	880 (13)	220 (25.0)	1.13	0.71	1.63	
Borgou	683 (10.1)	162 (23.7)	1.06	0.69	1.63	
Collines	564 (8.3)	170 (30.1)	1.47	0.98	2.19	
Couffo	572 (8.4)	177 (30.9)	1.53	1.05	2.21	
Donga	340 (5,)	88 (25.9)	1.19	0.59	2.38	
Littoral	568 (8.4)	148 (26.1)	1.2	0.83	1.73	
Mono	341 (5)	122 (35.8)	1.9	1.17	3.07	
Oueme	681 (10)	263 (38.6)	2.14	1.47	3.11	
Plateau	460 (6.8)	150 (32.6)	1.65	1.13	2.40	
Zou	671 (9.9)	156 (23.3)	1.03	0.71	1.50	
Residence						0.562
Rural	4483 (66.1)	1215 (27.1)	1			
Urban	2302 (33.9)	679 (29.5)	1.13	0.96	1.33	
Obesity						<0.0001
No	6157 (90.7)	1601 (26.0)	1			
Yes	629 (9.3)	293 (46.6)	2.48	2.09	2.93	
Profession						<0.0001
Government employee	219 (3.2)	61 (27.8)	1			
Employee, private sector	259 (3.8)	74 (28.6)	1.04	0.70	1.55	
Independent	5322 (78.7)	1440 (27.1)	0.96	0.71	1.29	
Apprentice	21 (0.3)	4 (19.1)	0.61	0.17	2.15	
Student	98 (1.5)	16 (16.3)	0.51	0.30	0.86	
Housewife	636 (9.4)	198 (31.1)	1.17	0.83	1.66	
Retired	109 (1.6)	57 (52.3)	2.84	1.80	4.48	
Unemployed	49 (0.7)	13 (26.5)	0.94	0.47	1.85	
Other	52 (0.8)	27 (51.9)	2.8	1.60	4.90	

(OR = 2.48; $p < 0.0001$) than people classified in the other BMI categories. The prevalence was higher in the Ouémé (38.6%) and Mono (35.8%) departments and lower in the Atacora (22.7%), Zou (23.3%), and Alibori (23.8%) departments ($p < 0.0001$). Taking Atacora as the reference department, the surveyed subjects in the Ouémé (OR = 2.14; $p < 0.0001$), Mono (OR = 1.90; $p = 0.009$), Plateau (OR = 1.65; $p = 0.01$), and Couffo (OR = 1.53; $p = 0.026$) departments were at higher risk for HTN. We also observed an association between socioprofessional categories and HTN. Retired persons (OR = 2.84; $p < 0.0001$) and ''other professions'' such as the disabled (OR = 2.80; $p < 0.0001$) were significantly more at risk for HTN.

In the multivariate analysis (Table 4), obese subjects were significantly more at risk than the nonobese (OR = 1.99; $p < 0.0001$). The risk of HTN was significantly higher in the 35–44 year-old (OR = 2.06; $p < 0.0001$), 45–54 year-old (OR = 3.44; $p < 0.0001$), and 55–64 year-old groups (OR = 5.41; $p < 0.0001$). The department of residence ($p = 0.292$) and profession ($p = 0.467$) did not appear as significant factors.

4. Discussion

This study was conducted following the STEPS method recommended by the WHO for screening and monitoring risk

Table 4
Distribution of odds ratios o hypertension (HTN) factors in multivariate analysis, STEPS survey, Benin 2008.

	HTN			
Factors	Adjusted OR	95% CI		*p*
Obesity				
No	1	–		
Yes	1.99	1.64	2.43	0.0001
Age group (years)				<0.0001
25–34	1			
35–44	2.06	1.72	2.50	
45–54	3.44	2.88	4.11	
55–64	5.41	4.56	6.43	
Department				0.292
Atacora	1			
Alibori	1.03	0.66	1.61	
Atlantique	0.99	0.66	1.49	
Borgou	0.9	0.57	1.43	
Collines	1.15	0.75	1.76	
Couffo	1.28	0.87	1.88	
Donga	0.88	0.46	1.68	
Littoral	1.01	0.65	1.57	
Mono	1.52	0.95	2.12	
Oueme	1.63	1.11	2.39	
Plateau	1.42	0.95	2.12	
Zou	0.91	0.60	1.40	
Residence				0.157
Rural	1			
Urban	1.13	0.95	1.35	
Profession				0.467
Government employee	1			
Employee, private sector	1.02	0.65	1.61	
Independent	0.8	0.58	1.11	
Apprentice	0.6	0.13	2.66	
Student	1.05	0.61	1.80	
Housewife	0.86	0.60	1.24	
Retired	0.94	0.57	1.56	
Unemployed	1.42	0.76	2.64	
Other	1.29	0.72	2.32	

factors of noncommunicable diseases [21]. This approach ensures that the results of STEPS studies conducted at different sites can be compared. The behavioral factors were studied based on subject declarations and therefore information and data biases may have been introduced. However, they were minimized in a context in which the factors studied were not stigmatizing and the times involved were short.

A five-stage sampling technique was applied to select the subjects. The absence of an exhaustive database of the dwellings and households by neighborhood/village explains the choice of the sampling plan. A representative sample was built, which allows extrapolation of the results to the entire Beninese population. The hypertension norms used corresponded to the WHO criteria [22]. The operational definition of HTN adopted took into account only the mean of two blood pressure measurements during the same day or a history of HTN. This definition was chosen in order to make the results comparable with other STEPS studies.

The prevalence of HTN observed in the present study is at the same level as that reported by studies conducted in other West African countries: Ghana (28.3%) in 2003 [23], Guinea (27%) in 2003 [12], and Côte d'Ivoire in 2005 (21.7%) [11]. However, it is more than double the prevalence report in Kinshasa, the capital of the Democratic Republic of Congo (11%) in 2004 [24]. In the Maghreb countries, the prevalence levels reported in Tunisia, Morocco, and Algeria are substantially higher [25]. The specificity of dietary habits in these countries could explain this divergence. This may also be related to the study population. In Tunis for example, the study investigated adults from 40 to 69 years of age, subjects at higher risk of having HTN, whereas the present study examined younger subjects from 25 to 64 years of age.

The increase in blood pressure with age has been described in the literature and conforms with the present study. The progressive aging of the population with the increase in life expectancy may partially explain the progression of HTN prevalence in Benin.

Overall, the prevalence of HTN in urban areas was not higher than in rural areas. The contrary was observed in Eritrea [4] and Ghana [26]. This could be explained by the limits used

in our study to determine urban versus rural setting. The last census tracts in 2002 were used to determine both rural and urban areas because there were no updated lists for 2008. Yet, certain rural zones had urbanized between 2002 and 2008, which makes interpretation of the results difficult. The fact that rural African populations are characterized by a traditional lifestyle associating cultural and dietary habits conducive to preventing HTN suggests a lower prevalence for these areas [26–28]. The results concerning the ''known, treated, and controlled HTN'' subgroup clearly show this trend. The prevalence of known HTN was higher in urban than in rural areas. In addition, the prevalence of treated HTN and controlled HTN was higher in persons with a university level of education living in urban settings. This observation could be explained by the greater purchasing power and the better understanding of the consequences of HTN, motivating the acquisition of medications and respect of treatment [27]. Overall, 81.6% of the hypertensive subjects had not taken their medications recently, which points to insufficient adherence to treatment, probably because of problems relating to access to healthcare.

We noted that obese individuals were at a higher risk of HTN, which has been observed in other studies [29–31]. Yet the proportion of obese individuals is increasing as a result of changing travel habits in the population, reducing physical exercise [30,31], and the adoption of a Western lifestyle. These changes, associated with an increase in stress, could account for the high prevalence in HTN in regions such as Ouémé. Traffic density and the stress brought about by smuggling activities in this department bordering Nigeria could be the cause. On the other hand, Atacora, Zou, and Borgou are essentially rural departments with low prevalence rates. It should be noted that associations of department and profession with HTN, observed in univariate analysis, disappeared in multivariate analysis after adjustment for age and body status. These two variables could be considered as factors that were not associated with the onset of HTN in our study. A more detailed study would be necessary to identify other factors of HTN in the various regions.

The results of this study on HTN reflect not only the low level of interest in the population for periodic verification of blood pressure, but also the fact that healthcare professionals do not systematically check blood pressure in at-risk elderly or obese persons. A similar observation was made in Nigeria [32]. If no intervention is set up, an increase in HTN and its cardiovascular complications can be expected in the coming years.

5. Conclusion

This study has measured the significance of HTN in the general population in Benin. More than one adult out of four has hypertension and nearly four subjects out of five are not aware that they have high blood pressure. These results are very worrying. It is therefore clear that effective preventive measures must be implemented to contribute to reducing the incidence, morbidity, and mortality caused by HTN. Moreover, they indicate the need to conduct more detailed research to explain the high prevalence of HTN in Ouémé as well as the lower prevalence in Atacora and Zou. Finally, periodic monitoring would make it possible to assess how the national HTN prevalence is evolving.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.respe.2011.09.010.

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