

## Prevalence and factors associated with hypertension in Anonkoi 3, a peri-urban area in Abidjan (Côte d'Ivoire)

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### Abstract

Hypertension affects more than a quarter of the world adult population, with rural-urban disparities. In Côte d'Ivoire, the prevalence was 21.7% in 2005. The aim of this study was to determine factors associated with hypertension in a peri-urban community in Abidjan. A cross-sectional study was conducted at Anonkoi 3 a peri-urban area in Abidjan. The sample was of 360 subjects aged 18 and older. Behavioral, anthropometric and blood pressure characteristics were determined using WHO STEPS questionnaire and multivariate logistic regression was performed. Prevalence of hypertension was 18.61%. Subjects were low fruit and vegetable consumption (3.3%), low level of physical activity (64.2%) and abdominal obesity at 40%. The risk of hypertension was significant from age 45, in subjects living with a partner and in those with low level of physical activity. Health education programs are essential to prevent cardiovascular risks.

### Introduction

Hypertension is responsible for at least 45% of deaths from cardiovascular diseases and 51% of stroke deaths worldwide.<sup>1</sup> More than a quarter of the global adult population is hypertensive and this proportion is expected to reach 29.2% by 2025, or nearly 1.6 billion people.<sup>2</sup> In sub-Saharan Africa, this condition currently affects approximately 27-28% of the adult population aged 20 years and over.<sup>2</sup> In addition, there are significant rural-urban disparities.<sup>3</sup> Studies in

sub-Saharan Africa reported low prevalence (<10%) of arterial hypertension in predominantly rural populations.<sup>4</sup> In Côte d'Ivoire, according to the estimates of the World Health Organization in relation to the STEPS study in 2005,<sup>5</sup> the overall prevalence of arterial hypertension was 21.7% and this was significantly more important in rural areas with 29.6% against 21% in urban areas. There is significant urbanization in this country and the capital Abidjan in its extension, occupies a part of the surrounding rural territories, thus favoring the creation of suburban districts.<sup>6</sup> These territories combine the characteristics of rural areas with low economic potential and those of the city. This environment determines the vulnerability of peri-urban populations to non-communicable diseases mainly related to lifestyle. Several neighborhoods of the Abobo commune, in the north part of the district of Abidjan are built on the territory of indigenous villages with the typology of suburban neighborhoods.<sup>5</sup> In 2016, the incidence rate of hypertension in the health district of Abobo West was 18.01 ‰, one of the highest in the Abidjan 2 health region.<sup>7</sup> These data from health facilities can be underestimated because the use of the health facilities is still low (45.26%) at the national level.<sup>7</sup> In addition, there is few data on arterial hypertension in Côte d'Ivoire. The aim of the present study was to determine the prevalence and risk factors associated with hypertension in Anonkoi 3, one of the peri-urban neighborhoods of Abobo West.

### Materials and Methods

#### Study design and setting

The study design was a cross-sectional survey conducted in November 2017. The study was carried out in Anonkoi 3. Anonkoi 3 is a peri-urban area belonging to the health district of Abobo-West. In the general census of the population in 2014, its population was estimated at 4814 inhabitants and the neighborhood had 754 households.<sup>8</sup> In the West Abobo health district, there is one referral hospital and the entire population lives within 5 km of a health center.<sup>7</sup>

#### Participants and Sampling

The study population consisted of adults aged 18 years and older who had been resident in Anonkoi 3 for at least six months and who had given oral consent. Pregnant and breastfeeding women were not included in the study because of the potential hypertensive disorders associated with pregnancy and postpartum.<sup>9</sup> The sam-

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ple size was determined from the Schwartz formula.<sup>10</sup> The prevalence of hypertension used was 21.7% from the WHO STEPS report in Côte d'Ivoire in 2005, the only available value for the entire country. The number of subjects obtained after calculation was 261. We extrapolated it to 360 subjects by taking into account possible non-responses. The subjects included in the study were selected by a two-degree random sample. We subdivided the neighborhood into 30 sectors using a plan. Households in these 30 sectors were identified by the team. For each sector, the first 12 randomly selected households were visited and one adult was interviewed per household. The choice of adult to be interviewed per household was random.

#### Data collection

A team of six trained investigators performed an electronic data collection using the MAGPI®. The interview, anthropometric measurements and blood pressure were conducted at the participant's home. The questionnaire used for the interview was the WHO STEPS questionnaire.<sup>5</sup> The

subject surveyed was seated during the entire interview which lasted 20 minutes on average. The questions focused on socio-demographic characteristics (age, gender, educational level, living with a partner, occupational category, number of children), family history of hypertension, behavioral risk factors (consumption of tobacco, alcohol, fruit and vegetables, level of physical activity). Each individual surveyed systematically had three blood pressure measurements taken by the same investigator. Systolic and diastolic blood pressure were taken in the right arm after 5 minutes of rest. At the end of the interview with each participant, the average of the blood pressure measurements was calculated. In case the PAS  $\geq$  140 mm Hg and/or the PAD  $\geq$  90 mm Hg, the participant was invited to contact the health structure in his district for a diagnosis and possibly treatment.

Subjects were considered as hypertensive when they had previously been diagnosed by a health professional or had ongoing antihypertensive therapy, or when they had a systolic blood pressure greater than or equal to 140 mmHg and/or diastolic blood pressure greater than or equal to 90 mmHg.<sup>11</sup> The weight was measured in kilograms (kg) using a TANITA® weighing scale to the nearest .1 kg. The measurement of participants height was done in centimeters using a stadiometer to the nearest .1cm. Concerning the body mass index (BMI), the following BMI categories were defined: underweight (BMI<18.5), normal weight (18.5≤BMI <25), overweight (25≤BMI <30), obesity (BMI  $\geq$  30).<sup>12</sup> Waist circumference was measured in cm in the narrowest sections of the trunk between the costal margin and the iliac crest; and the hip circumference as the widest section of the buttocks over the greater trochanters. Waist-to-hip Ratio (WHR) was determined by dividing waist circumference in cm by hip circumference in cm. A WHR of more than .8 for females and .95 for males was considered as abdominal obesity.<sup>12</sup> Smoking was assessed by defining the past and current smoking status of the participants interviewed.<sup>13</sup> Smoking was defined as individuals smoking daily or having smoked daily in the past. Non-smokers were those who smoked experimentally or not at all. Alcohol consumption was measured using the AUDIT-C test, which is an international screening test developed by WHO.<sup>14</sup> The AUDIT-C test refers to the last 12 months of the person's life. The AUDIT-C test was interpreted using the scores obtained: a score greater than or equal to 4 for men, 3 for women signs a Heavy drinking and a score greater than or equal to 5 for men, 4 for women signs an active alcohol depen-

dence.<sup>14,15</sup> All subjects with Heavy drinking and active alcohol dependence were categorized as alcohol consumers. And those who were not classified in these groups as non-drinkers. Fruit and vegetable consumption was assessed on the basis of 5 portion of fruits and vegetables, ie 400g recommended per day.<sup>16</sup> Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ).<sup>17</sup>

## Data analysis

The data was entered into the Excel® 2016 and then analyzed with Stata 13®. Qualitative variables were presented as numbers and percentages. Mean and standard deviation of the quantitative variables were calculated using a Chi-square or Fisher tests were used to assess differences in the proportion of hypertension. The associations between sociodemographic, BMI categories, abdominal obesity and health behavior variables and hypertension were

**Table 1. Socio-demographic, behavioral and metabolic characteristics (n=360).**

Variables	Frequencies (n)	%
<b>Sociodemographic characteristics</b>		
Age (years)		
18 – 35	226	62.8
35 – 45	74	20.5
$\geq$ 45	60	16.7
Gender		
Male	146	40.6
Female	214	59.4
Level of education		
None	71	19.7
Primary school	106	29.4
High school	136	37.8
University	47	13.1
Main occupation		
Unemployed	121	33.6
Employees	79	21.9
Informal private sector	160	44.4
Living with a partner		
No	212	58.9
Yes	148	41.1
<b>Behavioral characteristics</b>		
Tobacco consumption		
No	326	90.6
Yes	34	9.4
Alcohol consumption		
No	212	58.9
Yes	148	41.1
Fruits and vegetables consumption		
Less than 5 portions/day	348	96.7
5 portions and more/day	12	3.3
Physical activity		
Intense	18	5.0
Moderate	111	30.8
Low	231	64.2
Family History of HBP		
No	247	68.6
Yes	113	31.4
<b>Metabolic characteristics</b>		
BMI		
BMI < 18.5	31	8.6
18.5 $\leq$ BMI < 25	201	55.8
25 $\leq$ BMI < 30	67	18.6
BMI $\geq$ 30	61	16.9
Abdominal obesity		
No	216	60.0
Yes	144	40.0

BMI, body mass index; HBP, high blood pressure.

assessed in a two step procedure where individuals with hypertension were compared separately with those having no hypertension. In the first step, each variable was evaluated independently in a bivariate multinomial logistic regression analysis with hypertension as dependent variable to generate unadjusted OR. Those variables with P-values less than 0.2 were retained and entered into multinomial logistic regression model to determine variables that were independently associated with hypertension. A probability level of  $P < 0.05$  was considered significant.

### Ethical considerations

The study protocol was submitted to the scientific committee of the Training and Research Unit Pharmaceutical and Biological Sciences, which validated the methodological and ethical aspects. We obtained the prior authorization of community keepers and leaders. Oral consent was sought for each participant.

## Results

### Socio-demographic, behavioral and metabolic characteristics

As described in Table 1, the average age of participants was 33.51 ( $\pm 13.07$ ) years. The 25 to 34 age group was the most represented (36.9%). The sex ratio (M/F) was 0.68 denoting a female predominance. The level of education was low, participants with a university education level only represented 13.1% of the sample. More than half of the participants lived with a partner. As regards economic activities, the informal sector was the most represented with 44.4%.

The proportion of participants consuming at least 5 portions of fruits and vegetables per day was very low (3.3%). In addition, the majority of the participants had a low level of physical activity (64.2%). In contrast, the participants practically did not consume tobacco (90.6%), and did not consume alcohol in 58.9% of the cases.

Abdominal obesity was found in 2 out of 5 participants. Moreover, one out of five had obesity and overweight.

### Prevalence and associated factors of hypertension

The prevalence of hypertension was 18.61% (95% CI : 14.7-23.0). In addition, a family history of hypertension was reported in 31.4% of the cases. Twenty-one participants were on anti-hypertensives. Table 2 presents the univariate analysis of the prevalence

of hypertension by socio-demographic, behavioral and metabolic characteristics. The socio-demographic characteristics associated with hypertension were age ( $P < 0.001$ ), a live with a partner ( $P < 0.001$ ), a family history of hypertension ( $P = 0.042$ ). Regarding the behavioral data, only the level of physical activity was associated with high blood pressure ( $P = 0.045$ ). The metabolic factors studied

were all associated with hypertension. After logistic regression with adjustment for all covariates, participants aged 45 or older were 3 times more likely to have an hypertension (OR = 3.44, 95% CI : 1.60-7.43). For those living with a partner, this risk was two times higher compared to participants living without a partner (OR = 2.10, 95% CI : 1.08-4.11) (Table 3).

**Table 2. Prevalence of hypertension based on participants' sociodemographic, behavioral and nutritional characteristics (n = 360).**

	No Hypertensive n (%)	Hypertensive n (%)	P-value
<b>Sociodemographic factors</b>			
Gender			
Male	123(84.24)	23(15.8)	0.2499
Female	170(79.4)	44(20.6)	
Age (years)			
18 – 35	200(88.5)	26(11.5)	< 0.001
35 – 45	59(79.7)	15(20.3)	
≥ 45	34(56.7)	26(43.3)	
Main occupation			
Unemployed	98(81)	23(19.01)	0.9724
Employees	65(82.28)	14(17.72)	
Informal private sector	130(81.25)	30(18.75)	
Level of education			
None	55(77.46)	16(22.54)	0.089
Primary school	80(75.47)	26(24.53)	
High school	116(85.29)	20(14.71)	
University	42(89.36)	5(10.64)	
Living with a partner			
Yes	104(70.27)	44(29.7)	< 0.001
No	189(89.15)	23(10.8)	
<b>Behavioral Factors</b>			
Tobacco consumption			
No	269(81.5)	61(18.48)	0.8382
Yes	10(33.33)	20(66.67)	
Alcohol consumption			
No	170(80.19)	42(19.81)	0.484
Yes	123(83.11)	25(16.89)	
Fruits and vegetables consumption			
Less than 5 portions/day	283(81.32)	65(18.68)	1.000
5 portions and more/day	10(83.33)	2(16.67)	
Physical activity			
Intense	11(61.11)	7(38.89)	0.045
Moderate	95(85.59)	16(14.41)	
Low	187(80.95)	44(19.05)	
Family History of HBP			
No	208(84.2)	39(15.79)	0.042
Yes	85(75.22)	28(24.78)	
<b>Metabolic Factors</b>			
BMI			
BMI < 18,5	26(83.87)	5(16.13)	0.002
18,5 ≤ BMI < 25	169(84.08)	32(15.92)	
25 ≤ BMI < 30	59(88.06)	8(11.94)	
BMI ≥ 30	39(63.93)	22(36.07)	
Abdominal obesity			
No	185(85.65)	31(14.35)	0.011
Yes	108(75.00)	36(25.00)	

BMI, body mass index; HBP, high blood pressure.

## Discussion

The prevalence of hypertension at *Anonkoi 3* was relatively high. This prevalence reached the prevalence of 20.4% reported in 2014 in the city of *Adzopé* (south-east of *Côte d'Ivoire*).<sup>18</sup> In *Burkina Faso*, a study conducted in peri-urban areas in 2014 revealed a lower prevalence of hypertension of 11%.<sup>3</sup> In peri-urban areas, people are experiencing changes in lifestyle due to urbanization. The association between hypertension and age was found in our study. It is thought to be related to the increase in aortic stiffness observed with aging.<sup>13,19</sup> Dououlougou in *Burkina Faso* also

observed an increase in the prevalence of hypertension with age.<sup>3</sup> In addition, participants living with a partner were more likely to have hypertension. This could be justified by the stress of the negative quality of a life with a partner.<sup>20</sup> Similarly, Onwuchekwa had shown in a study in rural Nigeria that a high proportion of married people were hypertensive.<sup>21</sup> For him, being married did not offer the protection you would expect from having a companion.<sup>21</sup> Our study did not reveal a significant association between hypertension and smoking, alcoholism and non-consumption of fruits and vegetables; the proportion of subjects with these behavioural risk factors was low in the study population. Other studies in

Africa had also revealed this lack of association.<sup>22,23</sup> The effect of obesity on hypertension was not found in our study. Similarly, some authors in sub-Saharan Africa had made the same observation.<sup>3,21</sup> However, other studies showed an independent association between the Body Mass Index and hypertension.<sup>14,24</sup> On the other hand, low levels of physical activity did not increase the risk of high blood pressure. The proportions of physically active subjects were low in our study, which may justify this result. However, it has been described in the literature that regular physical activity would significantly reduce the risk of high blood pressure.<sup>25</sup>

**Table 3. Factors associated with hypertension and corresponding multivariate Odds Ratio in the Anonkoi 3 adult population (n=360).**

	Hypertensive n(%)	Unadjusted OR (95%CI)	P-value	Adjusted OR (95%CI)	P-value
<b>Gender</b>					
Female	44 (20.6)	1	-	-	-
Male	23 (15.8)	0.72 (0.41-1.25)	0.251	-	-
<b>Age (years)</b>					
[18 – 35[	26 (11.5)	1	-	1	-
[35 – 44[	15 (20.3)	1.96 (0.95-3.90)	0.060	1.28 (0.58-2.73)	0.535
≥ 45	26 (43.3)	5.88 (3.07-11.39)	<0.001	3.44 (1.60-7.43)	0.002
<b>Level of education</b>					
None	16 (22.5)	1	-	1	-
Primary school	26 (24.5)	1.12 (0.55-2.31)	0.760	0.95 (0.43-2.13)	0.896
High school	20 (14.7)	0.59 (0.29-1.24)	0.161	0.73 (0.32-1.68)	0.450
University	5 (10.6)	0.41 (0.13-1.14)	0.105	0.71 (0.20-2.21)	0.568
<b>Main occupation</b>					
Informal private sector	30 (18.8)	1	-	-	-
Unemployed	23 (19.0)	1.02 (0.55-1.85)	0.956	-	-
Employees	14 (17.7)	0.93 (0.45-1.85)	0.847	-	-
<b>Living with a partner</b>					
No	23 (10.8)	1	-	1	-
Yes	44 (29.7)	3.48(2.01-6.16)	<0.001	2.10(1.08-4.11)	0.029
<b>Tobacco consumption</b>					
No	60 (18.4)	1	-	-	-
Yes	7 (20.6)	1.15 (0.44-2.63)	0.756	-	-
<b>Alcohol consumption</b>					
No	42 (19.8)	1	-	-	-
Yes	25 (16.9)	0.82 (0.47-1.41)	0.484	-	-
<b>Fruits and vegetables consumption</b>					
5 portions and more/day	2 (16.7)	1	-	-	-
Less than 5 portions/day	65 (18.7)	1.15 (0.29-7.59)	0.860	-	-
<b>Family History of HBP</b>					
No	39 (15.8)	1	-	1	-
Yes	28 (24.8)	1.76 (1.01-3.03)	0.044	1.74 (0.94-3.22)	0.076
<b>BMI</b>					
Normal	32 (15.9)	1	-	1	-
Obese	22 (36.1)	2.98 (1.55-5.68)	0.001	1.84 (0.86-3.93)	0.117
Underweight	5 (16.1)	1.02 (0.32-2.65)	0.976	1.23 (0.36-3.55)	0.721
Overweight	8 (11.9)	0.72 (0.29-1.57)	0.430	0.49 (0.19-1.17)	0.127
<b>Abdominal obesity</b>					
No	31 (14.4)	1	-	1	-
Yes	36 (25.0)	1.99 (1.17-3.41)	0.012	1.29 (0.67-2.48)	0.444
<b>Physical Activity</b>					
Low	44 (19.0)	1	-	1	-
Intense	7(38.9)	2.70 (0.95-7.27)	0.052	2.63 (0.82-8.14)	0.094
Moderate	16 (14.4)	0.72 (0.37-1.31)	0.293	0.67 (0.33-1.31)	0.254

BMI, body mass index; HBP, high blood pressure; OR, odds ratio; CI, confidence interval.



## Study limitation

The blood pressure measurement was based on a single visit, which could have overestimated the prevalence of hypertension in our study. The rest period between measurements could have minimized this effect.

## Conclusions

The prevalence of hypertension in the peri-urban community of *Anonkoi* 3 was high. Populations of this peri-urban environment are exposed to this disease. Some predictors of high blood pressure have been identified in the community, including older age, living with a partner, and low levels of physical activity. Health education programs targeting at-risk populations should be intensified with emphasis on life styles to prevent cardiovascular risk. Thus, our study has enabled us to mobilize useful information for effective intervention in the field in the fight against high blood pressure.

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