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Arterial hypertension in a black peri-urban population in west Africa: analysis of some factors

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Abstract

Introduction *: Average blood pressure levels in sub-Saharan Africa increased significantly between 1975 and 2015 to some of the highest levels in the world. In Côte d'Ivoire, prevalence of hypertension increased from 24% in 2016 to 33% in 2017. The objective of this study was to describe some factors associated with hypertension in a peri-urban population in Côte d'Ivoire.*
Subjects and Methods *: From 24 April to 23 May 2014, a cross-sectional study was conducted in Abidjan (Côte d'Ivoire). It concerned adults aged 18 and over. Sociodemographic data and data from, blood pressure, corpulence, abdominal obesity, socioeconomic level, sedendarity, and level of physical activity were entered in Epi data software and analyzed using the R studio software . Univariate analysis using the Pearson KHI two test at a significance level of 0.05 and a logistic regression was performed.*
Results *: We recruited 486 adults 18 years and older. The average age was 36.10 ± 12.83 years. Prevalence of hypertension was 28.80%. In univariate analysis, age groups, marital status, socio-economic status, physical inactivity, obesity and abdominal obesity were associated with hypertension. After logistic regression, the 30-45 age groups (OR = 2.22; 95% CI = 1.27 to 3.93; p = 0.005) and 45 years and over (OR = 3.51; 95% CI = 1.94 to 6.45; p < 0.000); men (OR = 3.37; 95% CI = 1.69 to 6.98; p < 0.000); the richest (OR = 0.38; 95% CI = 0.15 to 0.95; p = 0.04); sedentary people with less than 4 hours of television sitting time (OR = 2.19; 95% CI = 1.20 to 4.18; p = 0.01); obesity (OR = 2.34; 95% CI = 1.31 to 4.16; p = 0.003) and abdominal obesity (OR = 2.12; 95% CI = 1.13 to 4.16; p = 0.02) were significantly associated with hypertension.*
Conclusion *: awareness actions must be carried out for this population.*

Keywords*: Africa, Prevalence, Hypertension, peri-urban*

Background

High blood pressure (HBP) is the leading global risk factor for cardiovascular disease (Zhou *et al*., 2017) and the leading preventable risk factor for premature death and disability worldwide (GBD 2013 Risk Factors Collaborators*, 2015). The global prevalence of hypertension in adults aged 18 years and older was estimated at around 22% in 2014 (World Health Organization, 2014) and is expected to increase to 29% by 2025 (Kearney *et al*., 2005). In addition, it is expected that the number of adults with hypertension in 2025 will increase by about 60%, to reach a total of 1.56 billion with a disproportionate prevalence in developing countries (Cappuccio and Miller, 2016; Kearney *et al*., 2005). In low- and middle-income countries, the global burden of hypertension is the heaviest, affecting about 1 in 3 adults (Abdalla, 2017). Several of these countries are undergoing an epidemiological transition from communicable diseases to non-communicable diseases (Bloom *et al*., 2012). Thus, these countries will continue to bear this heavy burden, while the levels of awareness and treatment of the fight against hypertension are still very low (Ibrahim and Damasceno, 2012).

It is estimated that by 2025, 75% of people with hypertension will live in low- and middle-income countries (van de Vijver *et al*., 2013). Africa has the highest prevalence with sometimes 46% of the population over 25 years of age ("WHO EMRO | Hypertension artérielle : un problème de santé publique | Journée mondiale de la Santé 2013 | Journée mondiale de la Santé," n.d.). For example, in sub-Saharan Africa (SSA) average blood pressure levels increased significantly

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between 1975 and 2015 to reach some of the highest levels in the world (Bosu *et al*., 2017). Projections suggest that by 2025, one hundred and fifty (150) million people will be hypertensive in this region (Seedat, 2000). In Côte d'Ivoire, the prevalence of high blood pressure has increased from 24% in 2016 to 33% in 2017. In most studies on hypertension in Africa and Côte d'Ivoire, the prevalence of hypertension varies from one country to another and according to the residential areas (Hendriks *et al*., 2012). Several surveys have been carried out in urban (Kingue *et al*., 2015; Malhotra *et al*., 2008) or rural areas (Arrey *et al*., 2016; Manus *et al*., 2018) and few data concern the peri-urban environment (Olowe and Ross, 2017). The peri-urban environment has the particularity of bringing together populations who have urban and rural habits and lifestyles. This environment is generally a dynamic and transient environment resulting from the mixing of surrounding urban and rural areas. The rate of population growth is high because of migration to cities (Makita *et al*., 2010). Thus, we conducted a study whose objective was to analyze some factors associated with hypertension in a peri-urban population of West Africa.

Subjects and Method

Study design

This study was conducted in Abidjan (Côte d'Ivoire) in the Anonkoi 3 neighborhood, a village in the municipality of Abobo, which is the second most populous municipality in Abidjan district, with a population density of 167 inhabitants per square kilometer (Sackou-Kouakou *et al*., 2016). The commune of Abobo brings together 28 districts and villages among which more than ten precarious districts and a shanty town. These neighborhoods are, for the most part, not serviced. Anonkoi 3 is an unserviced village in the municipality of Abobo (ONU, 2012).

Sampling

This was a cross-sectional study conducted from April 24 to May 23, 2014. The sample size was calculated according to the formula:

$n = p (1-p) Z2 / i^2$ with
n: sample size;
p: Prevalence of hypertension: 33.7% (WHO 2014) (ATTOH *et al*., 2016)
Z = 1.96 for a risk of error of 5% and i: accuracy (5%).
The calculated sample size was 343. Considering an 80% response rate, the minimum sample size was estimated at 429.

Sampling technique

Anonkoi 3 is a village in the municipality of Abidjan and the households are not numbered. According to the 1998 general population census, there were 474 households in this neighbourhood (INS-CIV: COTE D'IVOIRE - Recensement Générale de la Population et de l'Habitat, 1998). However, during a comprehensive study in this neighbourhood, Sackou Kouakou *et al*. identified 668 households (Sackou-Kouakou *et al*., 2016). We therefore carried out a random sampling, we calculated a sampling step of two (668/336=1.98). We considered as household Number 1 the first household found when we had access to the neighbourhood, so we visited one out of two households.

Study population

Included in this study were all adults 18 years of age and over who were not bedridden and present at the time of the survey. Pregnant or lactating women were not included. In each household visited, one adult aged 18 and over was selected. In the presence of more than one adult 18 years of age or older, only one person was selected by lot.

Data collection

Data collection was based on a pre-tested questionnaire after free and informed consent of the selected person (written or oral consent). The data collected were of various kinds :

- Sociodemographic data (age, sex, marital status, level of education).
- Blood pressure was measured by an OMRON® M^6 electronic blood pressure monitor with an cuff. Three measurements were taken after five minutes of rest. Persons with a systolic blood pressure greater than or equal to 140 mmHg and/or a diastolic blood pressure greater than or equal to 90 mmHg were considered to have hypertension.
- The corpulence was defined from Quételet's Body Mass Index (BMI) (OMS, 2000). Height was measured by a measuring tape and weight by a scale. Persons with a BMI of 30 kg/m^2 or more were considered obese and non-obese persons with a BMI less than 30 kg/m^2.
- Abdominal obesity was measured by a tape measure and defined as a waist circumference (WT) to hip circumference (TH) ratio greater than or equal to 0.80 in women and greater than or equal to 0.95 in men (Popkin Barry M *et al*., 2012).
- The socio-economic status was assessed by the poverty score or wealth index. This index was calculated using data on household ownership of material goods (e.g. televisions, bicycles, cars, materials used in housing construction, types of access to water and sanitation). The relative wealth scale was then classified into five categories (poorest, poorer, middle, richer and richest) according to the quintile of the sample (Neupane *et al*., 2016).

- Sedentary life was assessed by the time spent sitting in front of the television. Sedentary people were divided into two groups : sedentary people with a television viewing time of more than 4 hours and those with a television viewing time of less than 4 hours per day.
- The level of physical activity was assessed in three categories (low active, active and very active) by the International Physical Activity Questionnaire (IPAQ) in its short version. Then the "active and very active" categories were grouped into a single category called "active". Thus, the level of physical activity has been divided into "low active" and "active". The IPAQ questionnaire explores physical activity intensity (vigorous, moderate, low), frequency (days per week) and duration (hours / minutes per day). The IPAQ 2002 considers vigorous activities to be those that require significant physical effort and make breathing stronger (lifting heavy objects, aerobics, pedalling quickly). Moderate activities are those that require intermediate physical effort (lifting light objects, pedalling regularly, playing tennis).

Data analysis

The data were entered on the Epi data software (version 3.1) and analyzed with the R studio software version 1.1.447.

The search of factors associated with hypertension was conducted in two stages. First, we performed a univariate analysis using Pearson's KHI square test at the 0.05 significance threshold. Then, variables with a p-value less than 0.05 were included in a logistic regression model. The adjusted odds ratios and their 95% confidence intervals were calculated.

Ethical considerations

Survey participants were informed about the reasons for the study. Those who could read and write all agreed to fill out a personal identification form. For those who had no level of education (who could not read or write) oral consent was obtained. They then agreed to submit to the settings. Their free and informed consent was obtained before the start of the investigation. They were free to withdraw at any time from the investigation without prejudice. The data was collected anonymously.

Results

We recruited 486 adults aged 18 and older, including 327 women and 159 men, for a sex ratio (M / F) of 0.48. The mean age of our population was 36.10 ± 12.83 years, the mean systolic blood pressure was 132.01 mmHg and the mean diastolic blood pressure was 87.84 mmHg. Nearly half of the population lived in couples, about 2 in 5 had secondary education level and 1 in 3 had no level of education (not solarized). In this environment, the poorest represented 1/3 of the population. More than one-fifth of the population had a sedentary lifestyle of more than 4 hours sitting in front of the television and just over two-fifths (2/5) of the people were low. About 15% of this population was obese and more than half of the population was affected by abdominal obesity. The prevalence of hypertension was 28.8%.

Table 1 presents the distribution of the population according to the different factors and the associations between hypertension and these same factors. We have found a link between hypertension and several factors. Those factors were: age groups, marital status, socioeconomic status, sedentary lifestyle, general obesity and abdominal obesity. In fact, Hypertension was more common in the age group 45 and over. This age group was significantly three to four times more likely to have hypertension than those aged 15 to 30 (OR = 3.74, 95% CI = 2.22 to 6.41, p < 0.000). People living in couples were significantly more likely to have hypertension than single people (OR = 1.61; 95% CI = 1.08 to 2.41; p = 0.010). Poor people were significantly twice as likely to have hypertension as middle-class people (OR = 2.18, 95% CI= 1.08 to 9.50, p = 0.009), while richer people were less likely to have hypertension (OR = 0.58, 95% CI = 0.24 to 1.34, p = 0.009); sedentary people over 4 hours spent sitting in front of television were half as likely to have hypertension as sedentary people under 4 hours sitting in front of the television (OR = 0.48; 95% CI = 0.28 to 0.84; p = 0.008). People with general obesity are about two and a half times more likely to have hypertension than someone without general obesity (OR = 2.42; 95% CI = 1.40 to 4.17; p < 0.000) and individuals with abdominal obesity were almost twice as likely to have hypertension as those without abdominal obesity (OR = 1.75; 95% CI = 1.17 to 2.61; p = 0.005).

We did not find a link between the level of education with hypertension, nor did we observe a link between the level of physical activity and hypertension.

Table 2 presents the results of the multivariate analysis. Factors associated independently with hypertension were: age group 45 and over (OR adjusted = 3.51; 95% CI = 1.94 to 6.45; p < 0.000); male sex (OR adjusted = 3.37; 95% CI = 1.69 to 6.98; p < 0.000); the richest who were less likely to have hypertension (OR adjusted = 0.38; 95% CI = 0.15 to 0.95; p = 0.040); sedentary with less than 4 hours spent sitting in front of the television (OR = 2.19; 95% CI = 1.20 to 4.18; p = 0.010); those with general obesity (OR = 2.34; 95% CI = 1.31 to 4.16; p = 0.003) and people with abdominal obesity (OR = 2.12, 95% CI = 1.13 to 4.16, p = 0.020).

Nevertheless, marital status were no longer significantly associated with hypertension

Table 1: Sociodemographic factors and association between hypertension (HBP) and these same factors

	Numbers n = 486 (%)	HBP n = 140 (%)	No HBP N = 346 (%)	Adjusted OR	CI (95%)	P value
Age group (ans)						**<0.000****
15 – 30	184 (37.86)	29 (15.76)	155 (84.24)	1		
30 – 45	171 (35.18)	57 (33.33)	114 (66.67)	2.67	[1.61 to 4.48]	
45 – and more	131 (26.96)	54 (41.22)	77 (58.78)	3.74	[2.22 to 6.41]	
Sex						**0.370**
Women	327 (67.28)	90 (27.52)	237 (72.48)	0.82	[0.54 to 1.25]	
Men	159 (32.72)	50 (31.45)	109 (68.55)	1		
Marital status						**0.010***
Single	221 (45.47)	52 (23.53)	169 (76.47)	1		
In couple	265 (54.53)	88 (33.21)	177 (66.79)	1.61	[1.08 to 2.41]	
Socio-economic status						**0.009****
Poorest	162 (33.33)	44 (27.16)	118 (72.84)	1.11	[0.59 to 2.14]	
Poorer	83 (17.07)	35 (42.17)	48 (57.83)	2.18	[1.08 to 9.50]	
Middle	72 (14.82)	18 (25.00)	54 (75.00)	1		
Richer	102 (20.99)	32 (31.37)	70 (68.63)	1.37	[0.70 to 2.73]	
Richest	67 (13.79)	11 (16.42)	56 (83.58)	0.58	[0.24 to 1.34]	
Sedentarity						**0.008****
0 – 4 hours	383 (78.81)	121 (31.59)	262 (68.41)	1		
Over 4 hours	103(21.19)	19 (18.45)	84 (81.55)	0.48	[0.28 to 0.84]	
Obesity						**0.000*****
Yes	72 (14.82)	33 (45.83)	39 (54.17)	2.42	[1.40 to 4.17]	
No	414 (85.18)	107 (25.85)	307 (74.15)	1		
Abdominal obesity						**0.005****
Yes	247 (50.82)	85 (34.41)	162 (65.59)	1.75	[1.17 to 2.61]	
No	239 (49.18)	55 (23.01)	184 (76.99)	1		

OR: Odds Ratio; CI: Confidence Interval; 1: Reference category

Table 2 : Multivariate analysis of factors associated with hypertension

Variable	Adjusted OR	CI (95%)	P value
Age group			
30 - 45	2.22	[1.27 to 3.93]	0.005**
45 and over	3.51	[1.94 to 6.45]	<0.000***
Sex			
Men	3.37	[1.69 to 6.98]	<0.000***
Socio-economic status			
Richest	0.38	[0.15 to 0.95]	0.04*
Sedentarity			
0 – 4 hours	2.19	[1.20 to 4.18]	0.01*
Obesity			
Yes	2.34	[1.31 to 4.16]	0.003**
Abdominal obesity			
Yes	2.12	[1.13 to 4.16]	0.02*

**: 0.05 <p <0.01 ; **: 0.01 <p <0.001 ; *** p <0.001*

Discussion

This study, conducted in a peri-urban setting, aimed to determine the prevalence of arterial hypertension and to analyze some of the factors associated with hypertension in a West African population. It shows that 28.80% of the population, or more than one in four adults, had high blood pressure. In Africa, prevalence of hypertension

varies from one country to another and according to the place of residence (Hendriks *et al*., 2012). The prevalence of hypertension in this setting is similar to that reported in Uganda in peri-urban areas. In this study, Twinamasiko *et al*. noticed a prevalence of 24.5% for systolic hypertension and 31% for diastolic hypertension (Twinamasiko *et al*., 2018), while Soubeiga *et al*. reported a prevalence of 24.81% in urban areas in Burkina Faso (Soubeiga *et al*., 2017). The prevalence observed in our survey is higher than that found by other studies in Africa. Thus, in Tanzania, Mosha *et al*. reported a prevalence of 6.8% in rural areas and 10.1% in urban areas (Mosha *et al*., 2017), Soubeiga *et al*. found a prevalence of 15.37% in rural Burkina Faso while Nahimana *et al*. noticed a prevalence of 15.4% in Rwanda in both rural and urban areas (Nahimana *et al*., 2018; Soubeiga *et al*., 2017). These results show that the prevalence of high blood pressure varies from one country to another and from one setting to another.

We also noted that the age group 45 years and over, physical inactivity, general obesity and abdominal obesity were significantly related to hypertension. The link between age and hypertension is physiological because aging reduces the elasticity of the blood vessels, leading to an increase blood pressure. Our results are consistent with several other studies in which age, obesity and sedentary lifestyle were significantly associated with hypertension (Bosu *et al*., 2017; Guwatudde *et al*., 2015; Same *et al*., 2015; Twinamasiko *et al*., 2018). Of all these factors, obesity and a sedentary lifestyle are modifiable and can therefore be used as a basis for interventions to prevent hypertension.

In our study, people living in couples were significantly more likely to have hypertension than those living alone. This result could be explained by the fact that the couple can be a stressful and conflict-ridden environment. However, our results are inconsistent with those found in some studies that suggest that unattached individuals are more likely to have high blood pressure than those living with a partner. According to these surveys, the increased prevalence of hypertension among unattached individuals may be due to stress induced by the lack of psychosocial and economic support from the spouse. On the other hand, people living alone are more likely to lose interest in life and, therefore, engage in high-risk health behaviours (Kavishe *et al*., 2015; Nahimana *et al*., 2018; Schwandt *et al*., 2010).

In Anonkoi 3, poor people were significantly more than twice as likely to have hypertension as middle-class people, but richest were less likely to have hypertension. This observation could be explained by the fact that the richest have financial ressources to support their health. This observation is contrary to studies that note that hypertension was more frequent among workers with higher salary grades than those with lower salary, which would mean that hypertension is more prevalent among more wealthy workers than those with lower salary (Addo *et al*., 2008; Olatunbosun *et al*., 2000).

In this peri-urban environment, there was no link between the level of education and HTA, as some studies in sub-Saharan Africa (Mayega *et al*., 2012; Sodjinou *et al*., 2008; Wamala *et al*., 2009) have shown. However, Ogunlesi *et al* (Ogunlesi *et al*., 1991) found that among male workers, education level was significantly associated with blood pressure. Male workers with 13 years or more of education were two and a half times more likely to have hypertension than those with less than 10 years of education (Ogunlesi *et al*., 1991).

In this peri-urban environment, the prevalence of hypertension is comparable to that reported in sub-Saharan Africa. This HTA is associated with several factors. Also, it is important to carry out awareness actions to prevent not only high blood pressure but also its complications.

Limitations of the study

The authors recognize a number of limitations in this study. In fact, several other factors could have been studied, such as tobacco consumption, consumption of fruits and vegetables. Moreover, we did not consider hypertensive people on treatment. In addition, the sampling technique and the sedentary questionnaires could be sources of bias.

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Conflicts of interest

The authors do not report any conflict of interest.

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