Original Research Article

Prevalence of hypertension and its association with anthropometric indices among students of the University of Maroua (Far North Region, Cameroon)

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ABSTRACT

Aims: Hypertension (HTN) is one of the major public health problems in the world, especially in developing countries. The objective of this study was to evaluate its prevalence and its association with anthropometric indices among students of the University of Maroua.
Study design: A cross-sectional, analytical, and descriptive study was designed.
Place and Duration of Study: Two campuses of the University of Maroua located in the Far-North Region of Cameroon. Sampling was done between January and February 2018.
Methodology: A total of 330 Cameroonian and Chadian students aged 17 to 35 years were recruited. Anthropometric parameters (weight, height, waist, and hip circumference) and blood pressure were measured. Hypertension (HTN) was diagnosed according to the International Diabetes Federation (IDF) and the World Health Organization (WHO) criteria. Data were analyzed with Chi-square, Student t-test, simple linear regression, and multivariate analysis.
Results: The prevalence of HTN was 8.2% according to WHO criteria and 21.8% according to IDF criteria. Men were more affected (10%) than women (3.4%). Students aged 26-30 years old were the most affected (27%). Isolated diastolic hypertension (IDH) was the most common subtype in the general population, regardless of gender and nationality. Most participants with hypertension were in the pre-HTN stage (11.5%). Overweight (OR=3.73; 95% CI: 1.39-10.00) and waist-to-height ratio (WHtR) ≥0.5 (OR=3.64; 95% CI: 1.27-10.44) significantly increased the risk of developing HTN among students.
Conclusion: HTN is increasing among young students at the University of Maroua and is strongly associated with anthropometric indices such as BMI and WHtR. Regular monitoring of blood pressure, BMI, and WHtR will help early detection and prevention of the silent onset of HTN among these young people.

Keywords: Prevalence, hypertension, anthropometric indices, students, University of Maroua

1. INTRODUCTION

Hypertension is among the five leading causes of mortality worldwide. Globally, it contributes to more than 40% to cardiac-related deaths, with almost 70% being in low- and middle-income countries [1]. The disease is a silent threat to people's health, affecting up to one-third of the world's population [2]. The WHO data predicts a 1.56 billion (60%) increase in the global burden by the year 2025. In low- and middle-income countries, one in three adults suffers from hypertension [3]. It accounts for 20 to 50% of all deaths, especially in developing countries [4]. In Africa, HTN also affects the young population, although its diagnosis is generally done late [5] and mostly when associated complications affecting certain organs [6] such as the heart and kidney [7] are already quite developed. In Cameroon, the prevalence of HTN is estimated at 31% at the national level [8] and at 29.9% in Kaelé, a city in the Far North region of the country [9]. A prevalence of 12.7% was also noted among 15–35-year-olds at the national level [10]. Risk factors for HTN are related to lifestyle habits such as smoking, high consumption of high caloric and/or salty diets, and genetics [11].

With the high prevalence of HTN, it is evident that young adults are not spared, even with the low screening rate in this population [12]. Several studies have shown that hypertension and pre-hypertension can start in the teenage years, perhaps in the early stages of life, and continue into adulthood [13]. Young adults, characterized by the transition from adolescence to adulthood, are an important target of risk factors for several diseases; most of them experienced significant lifestyle changes, such as moving from their family home to university residences [14]. This important period in the life of young people makes them vulnerable to hypertension [15] and cardiovascular diseases [16]. Importantly, during this phase of life, young adults begin accumulating risk factors for high blood pressure such as obesity and abdominal fat accumulation [17]. For this purpose, body mass index (BMI), waist circumference (WC), waist-to-hip ratio (WHR), and waist-to-height ratio (WHR) are anthropometric indices used for the early diagnosis of obesity-related complications which may contribute to the development of hypertension [18]. However, many studies in different populations have shown differences in the ability of anthropometric indices to predict hypertension [19].

Most studies in Cameroon have examined the prevalence of hypertension in adults. Therefore, little is known about the case of university students. Furthermore, it is well known that hypertension is an asymptomatic disease that is revealed when related complications arise. It is therefore important to identify populations at risk through early detection at an earlier age. Hence, the present study was carried out to provide the current trends of HTN and to identify associated risk factors among the student population of the University of Maroua.

2. MATERIAL AND METHODS

2.1 Description of the population and place of study

A cross-sectional, descriptive, and analytical study was carried out in January and February 2018 on the two campuses (Ouro-chedé and Kongola) of the University of Maroua located in the Far-North Region of Cameroon. The University of Maroua is the only Cameroonian University located in the Sahelian zone of the country and therefore presents particular geographical and climatic constraints. A sample of 330 students aged 17 to 35 years, apparently healthy and non-hypertensives, were recruited at the Faculty of Human and Social Sciences (FHSS); the Faculty of Science (FS); the Faculty of Economics and Management Science (FEMS); the Faculty of Law and Political Sciences (FLPS); the National Polytechnic High School (NPHS) and the Higher Teachers' Training College (HTTC). Volunteer students who accepted to participate in the survey were enrolled. Those who were sick or under medication were excluded from the study. The sample size was computed considering a national HTN prevalence of 31% [8] and using Magnani formula [20]. A minimal sample size of 329 participants was required.

$$n = \frac{t^2 \times p(1-p)}{m^2}$$

2.2. Structured interview questionnaire

A face-to-face interview was conducted with each volunteer by a well-trained enumerator using a simplified questionnaire adapted from the STEP-wise approach for the metabolic disease surveillance instrument v2.1. Data were collected on age, socio-demographic status, lifestyle, familial and personal history of hypertension, smoking status, and alcohol consumption.

2.3. Anthropometric measurements and nutritional status assessment

Weight (to the nearest gram), height, and waist circumference (to the nearest centimeter) were measured with participants in light clothing and without shoes using standard methods. The body mass index (BMI) was computed and participants were classified according to WHO criteria [21] as normal weight (BMI between 18.5-24.9 kg/m2) and overweight (BMI ≥ 25 kg/m2). The International Diabetes Federation (IDF) African-specific criteria [22] (waist circumference (WC) ≥ 80 cm in women or ≥ 94 cm in men) and WHO criteria [21] (waist to hip ratio (WHR) > 0.90 in women or > 0.85 in men) were used to diagnose abdominal fat accumulation. Waist to height ratio (WHtR) estimated as WC (cm) divided by height (cm) was also used to detect abdominal fat accumulation. WHtR < 0.5 was considered as normal and ≥ 0.5 was considered as at risk of cardiometabolic disorders [23].

2.4. Blood pressure measurement and definition of high blood pressure

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Arterial blood pressure measurement was performed by a nurse using a SmartheartTM (Automatic Digital Blood Pressure Arm Monitor) on the left arm in a quiet room after the students had rested for at least 10 minutes in a sitting position. An appropriate size of the cuff and standard measures were taken to ensure accuracy. The left arm was placed at the same level as the heart during the measurement and two consecutive measurements were taken at an interval of at least five minutes. The average of the two measurements was used to assess the presence or absence of high blood pressure among participants. The IDF definition was used to assess high blood pressure (SBP ≥ 130 mmHg and/or DBP ≥ 85 mmHg) [22]. and the WHO definition for HTN (SBP ≥140 mmHg and/or DBP ≥ 90 mmHg) [21]. For the HTN subtypes, the following thresholds were used: isolated systolic HTN (SBP ≥ 130 and DBP < 85 mmHg); isolated diastolic HTN (SBP < 130 and DBP ≥ 85 mmHg), and systo-diastolic HTN (SBP ≥ 130 and a DBP ≥ 85 mmHg) [24]. The following thresholds were used to classify hypertensive patients according to the stage of the disease: pre-HTN (SBP = 130-139 mmHg and/or DBP = 85-89 mmHg); HTN grade 1 (SBP=140-159 mmHg and/or DBP= 90-99 mmHg); HTN grade 2 (SBP≥160 mmHg and/or DBP ≥ 100 mmHg) [25].

2.5. Data analysis

Data collected were analyzed using the Statistical Package for the Social Sciences (SPSS, version 20.0 for Windows). Descriptive statistics included frequency (%), and means ± Standard Deviation (SD). Chi-square and Student t-tests were performed to assess the difference between gender and nationality groups. Univariate analysis and multivariate logistic regression were performed to determine the associations between gender, waist circumference, WHR, BMI, WHtR, and hypertension. The significance level was adjusted to 0.05.

3. RESULTS

3.1. General characteristics of the study population

Out of the 330 students who took part in the survey, 120 (36.4%) were Chadians and 210 (63.6%) were Cameroonians. Among them, 73% (241) were men, and 27% (89) were women. The majority of participants were aged between 17 and 25 years. 89.7% of them were single while 10.3% were married. In addition, 81.5% of the students surveyed were undergraduates. 03 out of 330 were smokers while 68.2% (n=225) were alcohol consumers, and 17.6 of the students confirmed having a family history of HTN (Table 1).

Table 1. General characteristics of the study population

		Frequency n=330	Percentage (%)
Nationality	Cameroonian	210	63.6
	Chadian	120	36.4
Gender	Men	241	73.0
	Women	89	27.0
Age (years)	17-25	241	73.0
	26-30	63	19.1
	31-35	26	7.9
Marital status	Single	296	89.7
	Married	34	10.3
Level of education	undergraduate	269	81.5
	graduate	61	18.5

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Tobacco use	Yes	03	0.6
Alcohol consumption	Yes	225	68.2
Family history of HTN	Yes	58	17.6

3.2. Clinical characteristics of the study population

Table 2 represents the anthropometric and hemodynamic characteristics of the study population. The mean age was significantly higher among Cameroonians (p=0.003) and men (p=0.027) compared to Chadians and women, respectively. Regarding anthropometry, the Chadian student had a higher waist circumference (77.65±6.15 cm vs 75.20±8.09 cm for Cameronian); the female student exhibited a higher BMI (23.06±3.60 kg/m^2 vs 21.87±2.33 kg/m^2) and a higher WHtR (0.45±0.05 vs 0.43±0.03) while male students had a higher WHR (0.83±0.05 vs 0.80±0.08). The mean SBP was significantly higher among males (112.24±11.68 mmHg; p<0.05) compared to female students.

Table 2. Anthropometric and hemodynamic characteristics of the study population

Parameters	Overall	Nationality			Gender		
		Cameroonian	Chadian	P value	Female	Male	P value
Age (years)	23.95±3.67	24.40±3.82*	23.16±3.24	0.003	23.06±3.60	21.87±2.33*	0.027
BMI (kg/m²)	22.19±2.78	22.20±2.87	22.18±2.62	0.953	23.06±3.60	21.87±2.33*	0.001
WC (cm)	76.09±7.53	75.20±8.09*	77.65±6.15	0.004	74.81±9.62	76.57±6.55	0.060
WHR	0.82±0.06	0.82±0.07	0.83±0.04	0.193	0.80±0.08	0.83±0.05*	0.0001
WHtR	0.44±0.04	0.43±0.04	0.43±0.03	0.982	0.45±0.05	0.43±0.03*	0.001
SBP (mmHg)	111.42±11.08	111.72±11.28	110.90±10.75	0.519	109.19±8.95	112.24±11.68*	0.026
DBP (mmHg)	76.98±10.05	77.28±10.08	76.46±10.01	0.478	75.70±1.00	77.45±10.05	0.159
HR (beats/min)	83.00±18.36	81.66±15.56	85.36±22.33	0.078	83.43±11.73	82.85±20.29	0.799

*= Mean significantly different at P < 0.05, BMI = Body Mass Index, WC= Waist circumference, WHR= waist-to-hip ratio, WHtR = Waist to height ratio, SBP= Systolic Blood Pressure, DBP=Diastolic Blood Pressure, HR= Heart Rate.

3.3. Prevalence of hypertension in the study population

HTN was diagnosed according to the IDF and WHO definitions. Results in Figure 1 show that among the overall population, the prevalence of hypertension was 8.2% (WHO definition) and 21.8% (IDF definition). Male participants were the most affected compared to females, according to the IDF definition (p=0.002) (Fig. 1). Chadian students (24.2%) were slightly more affected by high blood pressure than Cameroonian students (20.5%)(Fig. 2). In addition, 11.5% of participants had prehypertension. However, the proportion of those in stages 1 and 2 was not negligible for a young population (6.1 and 0.6% respectively) (Fig. 4). IDH was the most prevalent subtype of HTN in the overall population, followed by the combined systolic/diastolic subtype. In addition, there was no case of the combined subtype (SDH) among female students (Fig. 3).

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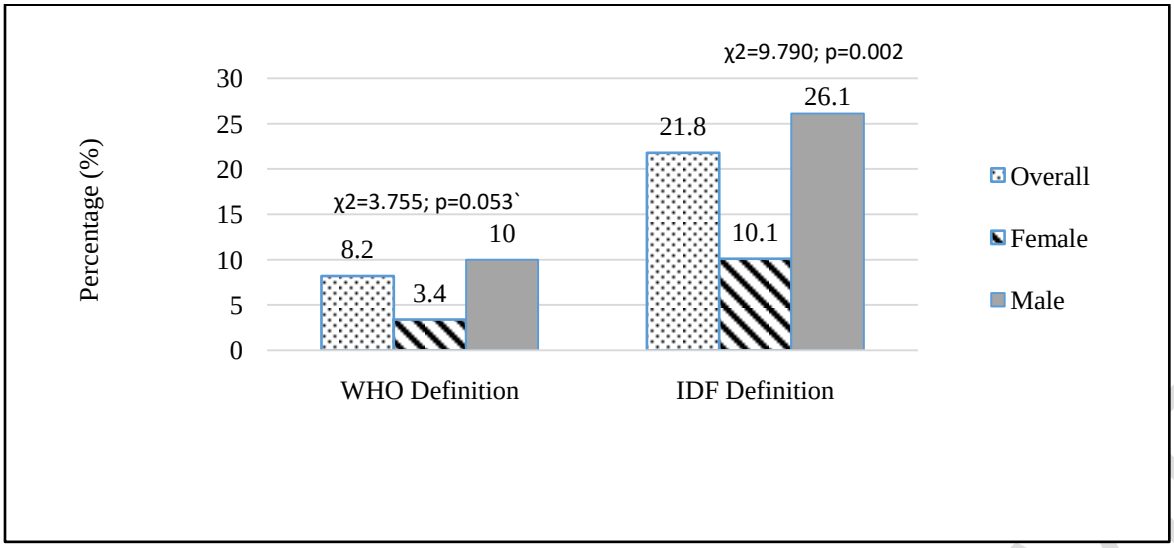

Figure 1. Prevalence of HTN in the overall population and according to gender using WHO and IDF definitions

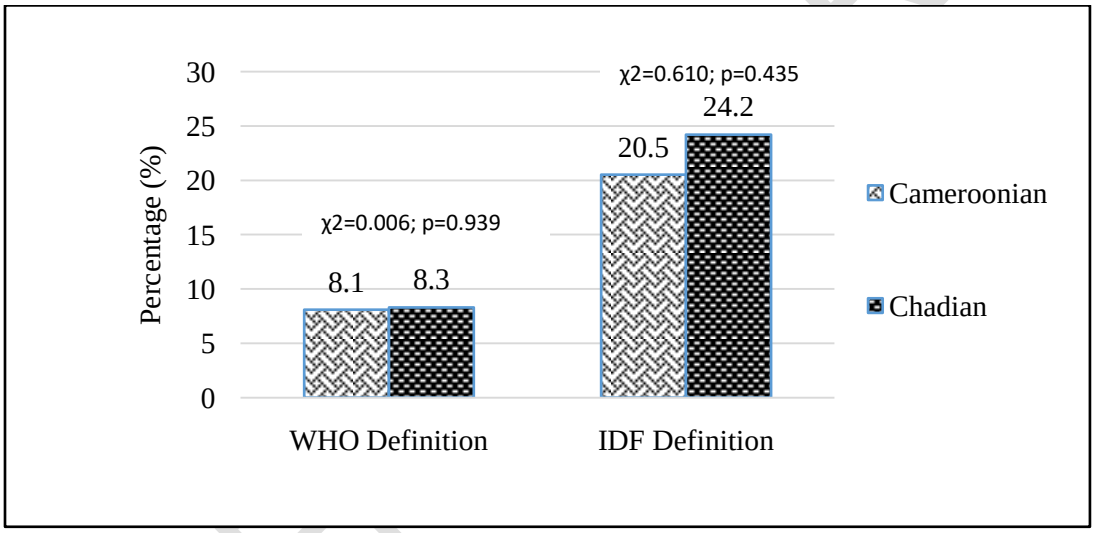

Figure 2. Prevalence of HTN according to student's country of origin using WHO and IDF definitions

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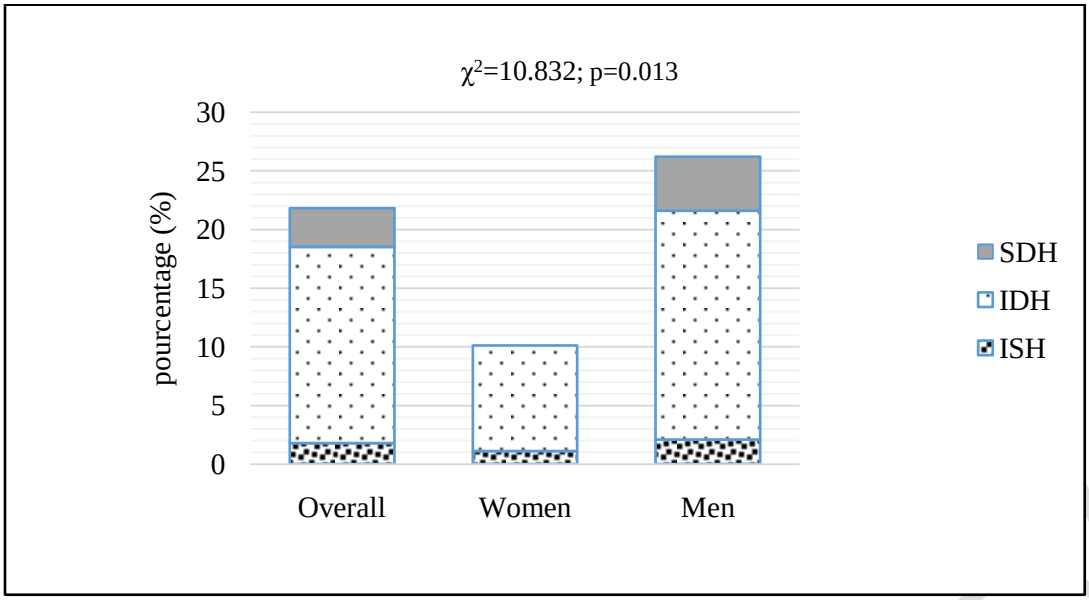

ISH : isolated systolic hypertension; IDH : isolated diastolic hypertension; SDH : systo-diastolic hypertension

Figure 3. Distribution of hypertensive participants according to HTN subtype using IDF definition

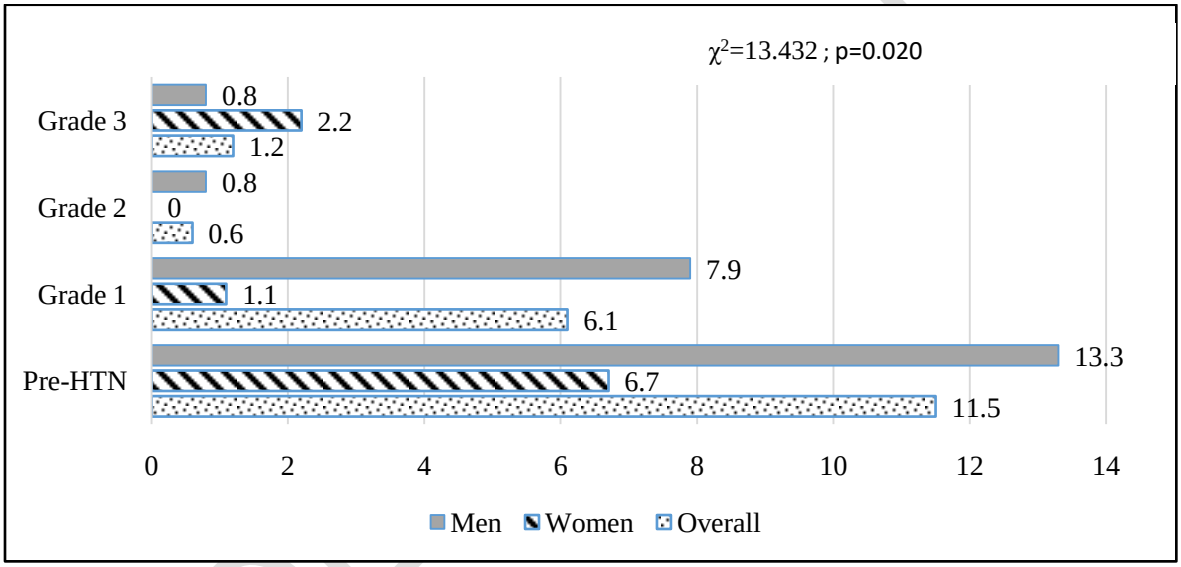

Figure 4. Distribution of hypertensive students according to the grade of HTN)

3.4. Distribution of hypertension by age strata in the study population

Table 3 shows that the 26-30 age group was the most affected by hypertension with 17 cases out of 63 participants (27%). Male and female students had a prevalence of 29.2% and 20.0%, respectively, for the 26-30 age group.

Table 3. Prevalence of hypertension by age strata according to the IDF criteria

	Age (years)			P value
	17-25	26-30	31-35	
	n=241	n= 63	n= 26	

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Overall	20.7 (50)	27 (17)	19.2 (5)	0.535
Women	8.7 (6)	20.0 (3)	0 (0)	0.485
Men	25.6 (44)	29.2(14)	23.8(5)	

Results are expressed as percentage % (n).

3.5. Contribution of anthropometric indices to the risk of developing hypertension in the study population

Among these participants, 40 (12.1%) and 28 (8.5%) presented abdominal fat accumulation according to IDF and WHO definitions, respectively; 43 (13%) were overweight and 39 (11.8%) had an at-risk WtHR. Moreover, being overweight (OR=3.73; 95% CI: 1.39-10.00) or having an at-risk WtHR (OR=3.64; 95% CI: 1.27-10.44) significantly increased the risk of developing hypertension among these students (Table 4).

Table 4: Evaluation of some anthropometric indices as risk factors for hypertension in the study population

Anthropometric indices		Frequency % (n)	P value	Odd ratio	P value	Odd ratio (gender control)	P value
high WC (IDF criteria)	No	87.9 (290)	0.0001	1		1	
	Yes	12.1 (40)		0.26 (0.03-1.97)	0.193	0.49 (0.05-4.49)	0.531
high WHR (WHO criteria)	No	91.5 (302)	0.0001	1		1	
	Yes	8.5 (28)		0.85 (0.19-3.80)	0.834	1.01 (0.22-4.54)	0.999
BMI≥25kg/m^2 (Overweight)	No	87 (287)	0.0001	1		1	
	Yes	13 (43)		2.59 (1.02-6.56)	0.044	3.73 (1.39-10.00)	0.009
WHtR ≥ 0.5 (At risk)	No	88.2 (291)	0.0001	1		1	
	Yes	11.8 (39)		2.33 (0.88-6.20)	0.088	3.64 (1.27-10.44)	0.016

WC= Waist circumference, WHR= waist to hip ratio, BMI = Body Mass Index, WHtR = Waist to height ratio.

4. Discussion

The prevalence of hypertension observed among students of the University of Maroua were 8.2% (WHO definition) and 21.8% (IDF definition). They are similar to those reported by Losimba *et al*. [6] among students at Kisangani University in the Democratic Republic of Congo (8%) but were lower than the 12.7% (WHO definition) obtained by Epacka *et al*. [10] among students at the University of Douala. These results were also contrary to those of Maha *et al*. [26] who reported a prevalence of 26.5% at the University of Damietta in Egypt. In addition, all these studies also noted a significant gender difference. A lower prevalence in women (3.4% according to the WHO definition and 10.1% according to the IDF definition) was noted (Fig. 1) as well as a higher prevalence of pre-HTN among men (13.2%) compared to women (6.7%) (Fig. 4). Similar observations were made by Peltzer *et al*. [27] among University students in the Association of Southeast Asian Nations (ASEAN) countries, where they found that 28.7% of male and 13.9% of female students were pre-hypertensive. This difference could be attributed to female hormones, particularly estrogen, which has a protective effect on the cardiovascular system through their vasodilatory effect on vascular endothelial cells [28, 29].

A slight difference was observed between the frequency of elevated blood pressure among Cameroonian versus Chadian students (20.5% versus 24.2%) (Fig. 2). This difference may be related to socio-economic, demographic, dietary, and geographical characteristics [30,31]. Regarding the HTN subtypes, the results (Fig. 3), were different from those reported by Abiodun *et al*. [32] where the combined form (SDH) was highest (77.6%) among 18 years of age and older in South-West Nigeria. The prevalence of pre-HTN (11.5%) observed among Maroua students (Fig. 4) was similar to those reported in studies conducted by Peltzer *et al*. [27] among Indonesian and Malaysian students. These authors noted an increased pre-HTN prevalence of 11.3% and 11.5%, respectively. However, these results were different from those of Chitrapu and Thakkallapalli [33] who observed 37.45% pre-HTN in 275 medical students in India. The observed difference can be attributed to socio-economic conditions of communities and lifestyle differences [34, 35]. In general, the dissimilarities observed between the two nationalities listed in terms of the prevalence of pre-hypertension can be attributed to the different stages of the epidemiological transition of the populations participating in the study and also to the effects of dynamic interactions between genetic, demographic, socio-cultural and economic factors [27]. Furthermore, most Chadian students lived far away from their parents or without guardians in the city of Maroua. As a result, they were at a higher risk of pre-HTN compared to Cameroonian students, many of whom were living with their parents or guardians. Previous studies have shown that students living away from their parents may be more influenced by lifestyle changes that increase the risk of development of pre-HTN and even HTN [13, 36].

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Regarding the association of age with hypertension, although previous studies have reported an increased prevalence of hypertension with age [37], our results showed a decrease in the prevalence of hypertension in the 31-35 years age group (19.2%) (Table 3). This observation is consistent with the work of Tanu *et al*. [38] who found that the prevalence of hypertension was high in younger age groups, particularly in developing countries. This high incidence of hypertension in our study population, which is mainly in the 26-30 years age group (27%), could be related to stress from academic workload and unhealthy lifestyle habits (unhealthy diet and lack of physical activities). Spruill's [39] had demonstrated that the high incidence of hypertension in the population may be partly due to career and life stress.
When considering the contribution of anthropometric indices to the occurrence of hypertension, our results are in agreement with those reported by other studies which have shown that a 5% weight gain is associated with a 20-30% increase in the risk of developing hypertension [40]. Indeed, being overweight is a major risk factor closely associated with hypertension. This occurs by activating the renin-angiotensin-aldosterone system, which has been considered to have an important function in the pathogenesis of obesity-related hypertension by causing vasoconstriction that leads to an increase in blood pressure [41]. Furthermore, this study found that a WtHR ≥0.5 was associated with a 3.64-fold increased risk of developing hypertension among students (Table 4). This result is consistent with the work of Lu *et al*. [42] who showed that the WtHR was positively associated with hypertension in young adults in the Southern part of China. Indeed, it has been reported that WHtR is a better marker of adiposity for detecting hypertension than BMI, waist circumference, and WHR [43, 19].

4. CONCLUSION

Hypertension was indeed present among students at the University of Maroua and Chadian students were slightly more affected compared to Cameroonian students. Isolated diastolic hypertension was the most prevalent subtype in the overall population, regardless of gender and nationality. Additionally, being overweight or having high WtHR were associated to an increased risk of HTN among this population. Thus, anthropometric indices such as BMI and WtHR can be considered as good markers of the risk of HTN.

CONSENT

All authors declare that written informed consents were obtained from the students.

ETHICAL APPROVAL

The study received approval from the National Ethics Committee of Research in Human Health of Cameroon No.2014/08/488/EC/CNERSH and each participant provided a written and signed consent form before enrollment in this study.

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