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Comparative Analysis of the Effects of Teaching Practice on Blood Pressure among Physical Education Teachers and Teachers of Other Subjects in Secondary Schools in Brazzaville, Republic of the Congo: A Cross-Sectional Study

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Abstract

Background: Hypertension is a major public health problem, exacerbated by sedentary lifestyles and work-related stress. The influence of the subject taught on blood pressure remains understudied in Congo. We compared the blood pressure and resting heart rate of physical education teachers with those of other subjects, and explored the associated occupational factors. **Methods:** A cross-sectional analytical study was conducted from May to October 2025 among 1014 teachers (525 physical education teachers; 489 teachers of other disciplines) from public secondary schools in Brazzaville. Sociodemographic and professional characteristics, physical activity, and stress levels were collected via questionnaire. Systolic and diastolic blood pressures and resting heart rate were measured according to a standardized protocol. Groups were compared using the chi-square test, Fisher's exact test, and Student's t-test (threshold of 0.05). **Results:** Physical education teachers more frequently engaged in physical activity outside of work (59.2% vs. 16.8%), all remained standing for extended periods (100% vs. 54.6%), and less frequently reported common work-related stress (6.9% vs. 72.8%) ($p < 0.001$). Hypertension was reported by 17.0% of physical education teachers and 43.76% of other teachers

($p < 0.001$). Systolic (120.6 ± 4.0 vs. 144.7 ± 4.1 mmHg) and diastolic (76.5 ± 5.4 vs. 93.0 ± 5.1 mmHg) blood pressures and resting heart rate (81.3 ± 8.1 vs. 90.2 ± 8.6 beats/min) were lower in PE teachers ($p < 0.001$). **Conclusion:** Physical education teachers exhibit more favorable blood pressure values, associated with a more active and less stressful professional profile. The cross-sectional design does not allow for the inference of causality. Promoting physical activity and regular hypertension screening is advisable for all teachers.

Keywords

High Blood Pressure, Teaching Practice, Sedentary Lifestyle, Psychological Stress and Congo

1. Introduction

High blood pressure (hypertension) is a major public health problem worldwide and one of the main risk factors for cardiovascular disease, stroke, and kidney failure [1]. Long considered a condition of middle-aged adults, elevated blood pressure is increasingly affecting young adults, particularly those exposed to significant occupational stresses [2].

Teachers constitute a potentially at-risk group due to mental workload, occupational stress, sedentary lifestyles, and workload [3]. Teacher occupational stress is described as an important psychosocial factor in the literature, notably in the work of Guiégui *et al.* (2023) [4], but its association with hypertension should not be interpreted as evidence of an increased prevalence of hypertension among teachers. In Africa, recent studies report that difficult working conditions, including overcrowded classrooms and limited infrastructure, contribute to elevated blood pressure among teachers [5] [6].

In Congo, the physical and mental health of teachers is attracting increasing interest, but few studies have compared the effect of the subject taught on cardiovascular health. Physical education teachers have a physically active job, which could have a protective effect on the cardiovascular system. Conversely, teachers of theoretical subjects (mathematics, literature, science) are more sedentary and subject to different cognitive and administrative pressures, potentially more detrimental to cardiovascular health. The aim of this study was to compare blood pressure and resting heart rate values of physical education teachers and teachers of other subjects in public middle and high schools in Brazzaville, and to identify associated occupational factors. We hypothesized that physical education teachers would have more favorable blood pressure values and that the influence of occupational factors on blood pressure would differ depending on the subject taught. We report here the results of a cross-sectional study conducted with 1014 teachers.

2. Methods

2.1. Type of Study and Framework

This is an analytical cross-sectional study, conducted from May to October 2025 in public secondary schools (*i.e.*, middle and high schools) in nine districts of Brazzaville. Using a 6/10 random sample, we selected the following districts: Makélékélé, Bacongo, Poto-Poto, Moungali, Ouenzé, and Talangaï. The manuscript was written in accordance with the STROBE recommendations for cross-sectional studies [7].

2.2. Participants

The target population comprised 1800 teachers. After random selection, our procedure, based on the sampling method, participation rate, and application of eligibility criteria, resulted in a final sample of 1014 teachers, including 525 physical education teachers and 489 teachers of other disciplines. This sample size was justified by refusals to participate and, in particular, absences on the day of testing or measurements. Teachers who were currently employed, had been teaching for at least four years, and had given their informed consent were included. Teachers who were absent or on sick leave, those with a known severe cardiovascular condition, and those on medication likely to significantly affect blood pressure were excluded. Sixty-three teachers on antihypertensive medication were excluded. Template is used to format your paper and style the text. All margins, column widths, line spaces, and text fonts are prescribed; please do not alter them. You may note peculiarities. For example, the head margin in this template measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire journals, and not as an independent document. Please do not revise any of the current designations.

2.3. Data Collection

A structured questionnaire was used to collect socio-demographic data such as sex, age, establishment, length of service and the subject taught. Work habits included the number of hours worked per week, the dominant standing or sitting posture and the frequency of perceived job tensions. The practice of personal physical activity outside of work and its weekly frequency were also recorded.

The level of physical activity was assessed using the short version of the International Physical Activity Questionnaire (IPAQ-SF) [8], which collects the frequency and duration of vigorous activities, moderate and walking over the past seven days. The results were expressed in MET-minutes/week and the participants were classified according to the thresholds of the official IPAQ protocol into three levels: low (criteria of moderate and high levels not reached), moderate (≥600 MET-min/week, or ≥5 days of walking and/or moderate activity for at least 30 minutes per day, or ≥3 days of vigorous activity for at least 20 minutes per day)

and high (≥3000 MET-min/week with at least 3 days of vigorous activity, or ≥7 days of combined activity reaching ≥ 3000 MET-min/week). Perceived stress was assessed using the Perceived Stress Scale at 10 items [9], in its validated French version [10]. The total score (0 - 40) was classified as low (0 - 13), moderate (14 - 26), and high (27 - 40) stress. A history of diagnosed hypertension, whether or not an antihypertensive treatment was taken and the date of the last blood pressure measurement were also collected.

Systolic blood pressure (SBP), diastolic blood pressure (DBP) and resting heart rate (HR) were measured while sitting after five minutes of rest using a validated electronic tensiometer [make, model, type of cuff, arm used], by [number and qualification of operators]. Only one measurement was performed per participant, during a single visit.

High blood pressure was defined as PAS ≥ 140 mmHg and/or PAD ≥ 90 mmHg. Participants who reported a diagnosis of hypertension or antihypertensive treatment were classified as known hypertensives. Given a single measurement, high values do not constitute a diagnosis of hypertension, which requires confirmation by repeated measurements during separate visits [10].

2.4. Statistical Analysis

The data were analyzed using SPSS version 25. Qualitative variables are expressed as counts and percentages, and quantitative variables as mean ± standard deviation. Comparisons between groups were performed using the chi-square test or Fisher's exact test for qualitative variables and Student's t-test for quantitative variables. The significance level was set at $p < 0.05$. No multivariate analysis was performed.

2.5. Ethical Considerations

The study was conducted in accordance with the principles of the Declaration of Helsinki [11]. The study protocol was approved by the Scientific Council of the Higher Institute of Physical Education and Sport, which acts as an ethics committee. All volunteers received oral and written information about the purpose and procedure of the study. They all completed an informed consent form before participating in the study. Administrative authorizations were obtained from the relevant educational authorities. All participants were informed of the study's objectives and gave their free and informed consent before being included. Anonymity and data confidentiality were guaranteed, and no personally identifiable information was collected.

3. Results

3.1. Characteristics of the Population

The sample comprised 1014 teachers, of whom 640 were men (63.1%). Teachers aged 41 and over represented 34.5% of the sample, 54.3% taught in middle schools, and 45.7% had between 11 and 20 years of experience (**Table 1**). Physical

education teachers represented 51.8% (n = 525) of the sample. The other subjects were mathematics (n = 98; 9.7%), history and geography (80; 7.9%), life and earth sciences and physical sciences (71 each; 7.0%), English (53; 5.2%), French (45; 4.4%), philosophy (35; 3.5%), computer science, and Spanish (18 each; 1.8%).

Table 1. Sociodemographic and professional characteristics of the 1014 teachers, Brazzaville.

Variable	Modality	Number (n)	%
Band	Physical Education Teachers	525	51.8
	Teachers of other disciplines	489	48.2
Sex	Male	640	63.1
	Female	374	36.9
Age (years)	20 - 30	319	31.5
	31 - 40	345	34.0
	≥41	350	34.5
Establishment	College	551	54.3
	High school	463	45.7
Seniority (years)	1 - 10	196	19.3
	11 - 20	463	45.7
	≥21	355	35.0
Total		1014	100

EPS: Physical and Sports Education.

3.2. Work Habits and Physical Activity

Physical education teachers had a lower weekly workload: none worked 20 to 24 hours, compared to 50.9% of teachers in other disciplines ($p < 0.001$). The majority of physical education teachers worked standing up (100%), compared to 54.6% of other teachers ($p < 0.001$). Frequent professional stress was reported by 6.9% of physical education teachers and 72.8% of other teachers ($p < 0.001$) (Table 2).

Personal physical activity outside of work was practiced by 59.2% of physical education teachers compared to 16.8% of other teachers ($p < 0.001$). Among the latter, 83.2% never engaged in any physical activity, compared to 40.8% of physical education teachers; two weekly sessions were reported by 8.4% of physical education teachers and by none of the other teachers ($p < 0.001$).

3.3. Arterial Hypertension, Treatment and Knowledge of Blood Pressure

Diagnosed hypertension was reported by 17.0% of physical education teachers and 56.0% of other teachers ($p < 0.001$). The use of antihypertensive medication was low in both groups (8.4% vs. 3.9%; $p = 0.003$). Physical education teachers

Table 2. Professional habits, physical activity and hypertension according to teacher group, Brazzaville, 2025.

Variable	Modality	EPS (n = 525) n (%)	Other disciplines (n = 489) n (%)	χ^2 (ddl)	p
Weekly hours	10 am - 2 pm	276 (52.6)	103 (21.1)	359.6 (2)	<0.001
	2 - 8 pm	249 (47.4)	137 (28.0)		
	20 - 24 hours	0 (0.0)	249 (50.9)		
Dominant posture	Standing	525 (100)	267 (54.6)	305.2 (1)	<0.001
	Seated	0 (0.0)	222 (45.4)		
Workplace tensions felt	Never	267 (50.9)	0 (0.0)	550.0 (2)	<0.001
	Sometimes	222 (42.3)	133 (27.2)		
	Often	36 (6.9)	356 (72.8)		
Physical activity outside of work	Yes	311 (59.2)	82 (16.8)	192.4 (1)	<0.001
	No	214 (40.8)	407 (83.2)		
Sessions per week	None	214 (40.8)	407 (83.2)	201.0 (2)	<0.001
	A	267 (50.9)	82 (16.8)		
	Two	44 (8.4)	0 (0.0)		
Diagnosed hypertension	Yes	89 (17.0)	215 (43.76)	556.9 (1)	<0.001
	No	436 (83.0)	275 (56.24)		
Antihypertensive treatment	Yes	44 (8.4)	19 (3.9)	8.8 (1)	0.003
	No	481 (91.6)	470 (96.1)		
Knows his latest blood pressure measurement	Yes	169 (32.2)	44 (9.0)	82.1 (1)	<0.001
	No	356 (67.8)	445 (91.0)		

HTA: arterial hypertension; EPS: physical education and sports; df: degrees of freedom. Diagnosed hypertension, treatment, and knowledge of the last measurement: self-reported data. Chi-square test.

were more likely to know their most recent blood pressure reading (32.2% vs. 9.0%; $p < 0.001$) (Table 3).

3.4. Blood Pressure Values and Resting Heart Rate

Measurements were available for 519 physical education teachers and 455 teachers of other disciplines. This discrepancy can be explained by refusal to participate in the measurement and, above all, by absence on the day of testing. The mean systolic blood pressure (SBP) (120.6 ± 6.07 vs. 144.7 ± 4.1 mmHg), diastolic blood pressure (DBP) (76.5 ± 5.04 vs. 93.0 ± 5.01 mmHg), and heart rate (HRr) (81.3 ± 8.01 vs. 90.2 ± 8.06 beats/min) were significantly lower in physical education teachers ($p < 0.001$).

Table 3. Shows the knowledge and treatment of blood pressure among teachers regarding their health status, comparing PE teachers with those of other disciplines.

	Items	EEPS n (%)	EAD n (%)	χ^2
Q11	Yes	89 (16.95)	445 (90.90)	16.76***
	No	436 (83.05)	44 (9.10)	
Q12	Yes	44 (8.47)	19 (3.80)	10.30**
	No	481 (91.53)	470 (96.20)	
Q13	Yes	169 (32.20)	44 (9.10)	16.76***
	No	356 (67.80)	445 (90.90)	
Total		525 (100)	489 (100)	1014

Table 4. Comparison of blood pressure values and resting heart rate (mean ± standard deviation), Brazzaville.

Variable	EPS (n = 519)	Other disciplines (n = 455)	p
PAS (mmHg)	120.6 ± 6.07	144.07 ± 4.1	<0.001
PAD (mmHg)	76.5 ± 5.4	93.0 ± 5.1	<0.001
HR (beats/min)	81.3 ± 8.1	90.2 ± 8.6	<0.001

SBP: systolic blood pressure; DBP: diastolic blood pressure; HRr: resting heart rate; EPS: physical education and sports. Student's t-test.

4. Discussion

Main results

In this cross-sectional study of 1014 teachers in Brazzaville, physical education teachers had lower PAS (Personal Activity Scale), PAD (Personal Activity Decompression Scale), and FCr (Functional Activity Ratio) values than their colleagues in other disciplines, as well as a more active professional profile (standing posture, physical activity outside of work) and less stress. These results are consistent with the initial hypothesis, but do not allow for a conclusion of a causal relationship (Table 4).

Strengths of the study

The study's strengths include its large sample size, the comparable size of the two groups, recruitment from all nine boroughs of the city, and the standardized blood pressure measurement based on the average of two readings. Its weaknesses are detailed in the Limitations section.

Comparison with literature

The observed differences are consistent with the recognized protective role of regular physical activity on blood pressure and cardiovascular risk [12] [13]. This active professional stance, combined with more frequent physical activity outside of work (59.2% vs. 16.8%), reflects a professional and cultural integration of physical activity among physical education teachers. The lower frequency of work-related stress among these teachers is consistent with the effect of physical activity

on stress regulation and autonomic nervous system balance [14] [15]. However, it may also reflect different working conditions, particularly a lower weekly teaching load, the effects of which on teacher stress have been described in Africa and elsewhere [4] [5]. The higher values of systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HRc) among teachers of other disciplines are consistent with the effects of sedentary lifestyles and chronic stress on the cardiovascular system [16]-[18]. The male predominance (63.1%) and the significant proportion of teachers aged 41 and over (34.5%) reflect a gender imbalance and an aging of the teaching staff already described in Africa [19] [20].

Significant differences in the results

Screening campaigns have reported a prevalence of hypertension of 33.5% in 2019 [21], 22.2% in 2018, and 41% in Brazzaville in 2017 [22]. Among older women, the prevalence was 24.8% in sub-Saharan Africa. Even among individuals aged 65 years and older in Central Africa, the EPIDEMCA study reported a prevalence of 61.1% [21].

Our result in **Table 1** falls between these values, including those observed in much older populations. This may be explained by the mean age of the teachers, the non-representative nature of the volunteer sample, and the fact that blood pressure was measured only once, without confirmation during a second visit. Combined with a very low treatment rate (3.9%), this finding suggests either substantial undertreatment of hypertension or the presence of measurement or reporting bias, which should be ruled out by verifying the definition of hypertension used and the underlying data.

Similarly, the more frequent knowledge of the most recent blood pressure value among physical education teachers (32.2% vs. 9.0%) indicates greater awareness of cardiovascular health, which may itself contribute to the observed differences.

Significance of the study and perspectives

These results (**Table 1** and **Table 3**) support the integration of programs promoting physical activity, stress management, and regular hypertension screening into the educational environment, targeting all teachers, with priority given to those teaching non-physical subjects. Longitudinal studies, adjusting for age, sex, seniority, body mass index, smoking, and alcohol consumption, and incorporating objective measurements of physical activity (accelerometer) and blood pressure (ambulatory blood pressure monitoring), are needed to clarify the role of occupational activity in the observed differences.

Boundaries

The cross-sectional design does not allow for establishing causality. The lack of multivariate adjustment for confounding factors such as age, sex, body mass index, or seniority limits the interpretation of the comparisons. Hypertension, physical activity, and stress were self-reported, which exposes the participants to recall and social desirability biases. A "healthy worker" selection bias is possible, as individuals in good physical condition are more likely to choose physical education. Blood pressure was measured during only one visit, which does not allow for con-

firmation of a hypertension diagnosis. Finally, the two groups differed in their working hours. The sample was limited to three of the ten districts that make up Brazzaville.

Conclusion

This study highlights more favorable blood pressure and resting heart rate values among physical education teachers in Brazzaville than among teachers of other disciplines, associated with a more active and less stressful professional profile. The cross-sectional nature of the study and the lack of multivariate adjustment preclude concluding that teaching practice is causally linked. These results justify the implementation of cardiovascular prevention and workplace well-being strategies for all teachers, as well as longitudinal studies adjusted for confounding factors.

What we already know about this subject

High blood pressure is a major risk factor for cardiovascular disease and is increasingly affecting young adults exposed to work-related stress. In Africa, difficult working conditions are associated with higher blood pressure among teachers. There is little Congolese data comparing teachers' blood pressure according to the subject they teach.

What this study reveals

Physical education teachers in Brazzaville have lower systolic and diastolic blood pressures and resting heart rates than those in other disciplines. They also have a more active professional profile (standing posture, physical activity outside of work) and report less professional tension. Antihypertensive treatment is rarely used in either group, which justifies regular screening of all teachers.

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Author Contributions

Study design and planning: Yvon Rock Ghislain ALONGO. Data acquisition: Régis Prince Epele, Data analysis and interpretation: Anon Felix N'dia, Manuscript written by: Aimé Simplice Christophe Ambeto, Critical review of the manuscript focusing on its important intellectual content: Kiel Itoua Oniangue Assoba, Statistical analysis: Simplice Innocent Moussouami, Administrative, technical and material support: Chelmy Ibata Ondze, Study supervision: Raoul AMPA.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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