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Practicing One Sport per Week Could Help to Control Blood Pressure: An Exploratory Study among Secondary Pupils in Northern Benin

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Abstract

The prevention of cardiovascular disease could be better efficient if the follow-up of blood pressure (BP) profile was effective during childhood. Investigations on the normal range of blood pressure during early life and adolescence were not sufficiently documented in African countries for foreseeing adequate prevented health public actions. This study aims to determine the blood pressure profile in apparently healthy pupils and to identify modifiable risk factors (diet, lifestyle, and weight status). Ninety-five pupils were included in the study and their blood pressure was measured. A questionnaire was administered to them for approaching the factors associated with profile blood pressure. Anthropometrics measurements were performed by personal trained according to WHO recommendations. The mean of Systolic Blood Pressure (SBP)/Diastolic Blood Pressure (DBP) of sampled pupils was SBP/DBP 107.53 ± 6.18/78.16 ± 4.43 mmHg. Only one pupil had high blood pressure (BP: 120 to 129 mm Hg systolic and less than 80 mm Hg diastolic). Adjusting for age and sex, Body mass index for age (BAZ), like to eat less salt and drink alcohol and practicing sport were associated to increase BP profile of pupils. Meanwhile, duration of sport practice and consumption of less fatty food was associated with low blood pressure (systolic or diastolic). The duration of practice per week appeared to be significantly and negatively associated with high blood pressure. Children who practiced more than 4 hours of sport per week had a diastolic blood pressure of less than 4.54 mmHg than those who practiced sport for less than 4 hours ($p = 0.00$). Playing sports at school for more than four hours a week and not exposing at school to alcohol and fatty foods could help control blood pressure in pupils. However, further research will be required to confirm these findings.

Keywords

Blood Pressure, Physical Activity, School, North Benin, Hypertension

1. Introduction

Hypertension (HBP) is the most important cardiovascular risk factor and a major public health problem worldwide. WHO estimated around 1.28 billion adults aged 30 - 79 years worldwide are affected, most living in low- and middle-income countries (WHO, 2021a). In Africa, the global prevalence of HBP varied from 0.2% to 24.8% (Noubiap et al., 2017). In Benin, HBP represents 15% of the reasons for consultation in hospitals and it leads to hospital mortality varying between 3% and 7% (MS, 2016). Hypertension is accounting for 4.4% of global mortality (Edmond, 1987).

Although the prevalence of HBP is much lower in children and adolescents, growing evidence suggests that hypertension begins to develop in the first two decades of life (Muntner et al., 2004; Noubiap et al., 2017; Okpokowuruk et al., 2017). In developing countries, HBP prevalence is also increasing among children, due to an epidemic of childhood obesity (WHO, 2021b). Numerous studies (Sorof & Daniels, 2002; Muntner et al., 2004; Lalya et al., 2018; Desormais et al., 2019; Song et al., 2019) have reported the follow-up effect of blood pressure (BP) from childhood to adulthood. These authors showed that BP trend over time in children may be important predictors of later hypertension trends in adulthood.

Factors such as family history of high BP, male gender, higher BMI, and cigarette smoking were associated with increasing BP in several countries (Muntner et al., 2004). A diet with high calories, rich in salt, and alcohol consumption, were also found to be associated with HBP (Sorof & Daniels, 2002). Although physical activities practiced at a good frequency have a positive impact on the control of hypertension, a poor diet, lifestyle, or hygiene would not highlight the benefits of physical practice in the effective prevention of hypertension from adolescence to adulthood.

The prevention of cardiovascular disease could be better if the follow-up of BP profile is effective during childhood and adolescence. Therefore, it is necessary to study the normal range of blood pressure during early life. This kind of study was not sufficiently investigated in African countries for allowing to foresee the appropriate preventive health public actions. Most of the studies that investigated the HBP in Benin were carried out on adults and sometimes on children and more in southern Benin (Houinato et al., 2012; Makoutode et al., 2017; Lalya et al., 2018; Desormais et al., 2019; Mama Cisse et al., 2020).

To our knowledge, the studies on blood pressure in schoolchildren are rare in the north of Benin. However, this investigation aims to determine the blood pressure profile in apparently healthy schoolchildren and to reveal the modifiable risk factors protectors (diet, lifestyle, hygiene, and weight status). This will

contribute to planning the potential actions that can be considered for blood pressure control early.

2. Methods

2.1. Population and Area Study

The study was cross-sectional study conducted in Pehunco, located in North Benin region. The participants were adolescents attending secondary school and living in urban regions. They were aged 10 - 19 years and chosen by convenience sampling. The pupils who were exempted to practice educational physique activities and those who have not accepted to participate in the study were excluded. This study is prior to the promotion of physical activities among secondary school children. Participants of the study were from of first and second form in school and a follow up is planned during their cycle in secondary. In total 95 students were included in the study. This study was conducted from May to July 2021.

2.2. Data Collected

2.2.1. The Blood Pressure (SBP and DBP)

Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured by electronic blood pressure monitor (SCIAN model LD-526, China). BP was recorded in a large classroom with the subject sitting comfortably on a chair and the arm resting at heart level on a table. Measurements were taken after a five-minute rest and in the morning before physical exercise (Riley et al., 2018). BP reading was taken by the same trained observer throughout the study. The BP for each subject is taken as the average of the two readings.

2.2.2. Anthropometrics Measurements

The weight and height of the participants were measured for each participant. The weight was measured by balance electronic, type SECA, 874.

Anthropometrics measurements were performed by trained operators according to WHO recommendations. Weight was measured to the nearest 0.1 kg using an electronic portable scale (SECA 874, Germany) with the children/adolescents barefoot and wearing light clothes. Height was measured to the nearest 0.1 cm using a stadiometer (ShorrBoard, Portable Height-Length Measuring Board) with the children/adolescents barefoot in a standing position.

2.2.3. Modifiable Risk Factors

The factors included in this study were unhealthy diet (excessive salt consumption, a diet high in saturated), physical inactivity, and consumption of tobacco and alcohol. These data were collected by a questionnaire structured and administered to schoolchildren.

2.3. Data Analysis

After cleaning data, the variables are related to blood pressure profile and modifiable risk factors (diet, lifestyle, and weight status). In the study, High Blood

pressure (HBP) is considered as systolic blood pressure ranged 120 to 129 mm Hg and diastolic, less than 80 mm Hg.

The independent variables were sex, physical activity practice (competitive sports and simple physical activities: housework or passive sport), and modifiable risk factors (diet and lifestyle). The lifestyle and physical activity variables were:

- Participation in competitive sports (Yes/No);
- Time spent in competitive sport (<6 h/≥6h);
- Physical activities other than competitive sport (Yes/No);
- Means of transport (Foot/ or bike/ Motorbike);
- Duration of locomotion per day (<30 min; ≥30 min);
- Sleep during the day (Yes; No);
- Time sitting in front of a media mass (<3 h; ≥3 h).

Software for assessing growth of the world's children and adolescents (WHO Antho) was used to calculate the Body-mass-index-for-Age, BMI-for-Age-Z-score (BAZ). According to WHO, for children 5 - 19 years, the +1 SD cut-off is considered overweight and +2 SD cut-off as obesity. For thinness and severe thinness, −2 and −3 SD were used, respectively (WHO, 2009).

After the normality test, to compare the characteristics between girls and boys, an independent sample t-student test was used. Otherwise, a non-parametric test was used. Factors associated with the students' blood pressure profiles were identified with a linear regression model. The 5% level was considered significant.

3. Results

The description of the pupils' sample is presented in Table 1. Their average age was 14.83 ± 1.79 y. The average age of boys (15.30 ± 1.7 y) was significantly (p = 0.003) higher than that of girls (14.22 ± 1.7 y). For the height, the observation was the same. The average height of the pupils surveyed was 161.59 ± 6.87 cm and that of the boys was 162.81 ± 7.15 cm which was higher than those of girls (159.98 ± 6.2 cm).

Table 1. Characteristics of the sample of pupils.

Parameters	Total (n = 95)	Boys (n1 = 54)	Girls (n2 = 41)	p
		Mean ± SD		
Age (years)	14.83 ± 1.79	15.30 ± 1.7	14.22 ± 1.7	0.002
Weight (kg)	51.12 ± 9.94	51.76 ± 8.63	50.29 ± 11.5	0.240
Height (cm)	161.59 ± 6.87	162.81 ± 7.15	159.98 ± 6.2	0.022
BAZ (kg/m^2)	−0.31 ± 1.26	−0.37 ± 1.22	−0.24 ± 1.32	0.690
SBP (mmHg)	107.53 ± 6.18	108.52 ± 5.87	106.22 ± 6.4	0.030
DBP (mmHg)	78.16 ± 4.43	78.61 ± 4.59	77.56 ± 4.2	0.120

Systolic Blood Pressure (SBP); Diastolic Blood Pressure (DBP); BAZ: Body mass index for Age; M: Means; SD: Standard Deviation.

3.1. Ponderal Status of Pupils

Figure 1 shows the weight status of the pupils. It can be seen that around 9.47% of children overweighed with 2.1% obese. Among the boys, around exceeds that of girls (37%).

3.2. Blood Pressure Profile of Children

In our sample, only one child had a high blood sample (1.05%). Every child has normal blood pressure.

3.3. Lifestyle and Physical Activity Practices

Table 2 provides information on the lifestyle of pupils. It shows that almost the pupils practiced sports (99%). Boys practiced more competitive sports (81.5%) than girls (40%). Among the competitive sports, football was more practiced by boys (44%) than by girls (5%). On the other hand, handball is played by girls (35%) more than by boys (17%).

More than half (63%) of the pupils spent at least 4 hours a week in doing sports. This was 65% for girls and 63% for boys. Fifty-nine percent (59%) of them practiced a physical activity other than competitive sports. These activities include work in the fields and hunting. Around 54% of girls have not engaged in any physical activity apart from competitive sports. That was unlike the boys. Furthermore, 86% of pupils moved to school on foot or by bicycle. Sixty-one (61%) among pupils had a rest time of less than or equal to 30 min per day. Moreover, more than half of the pupils watched television (77%).

Seventy-one percent (71%) of pupils spent no more than 3 hours on the mass media. The same trend has been observed among both girls (78%) and boys (65%).

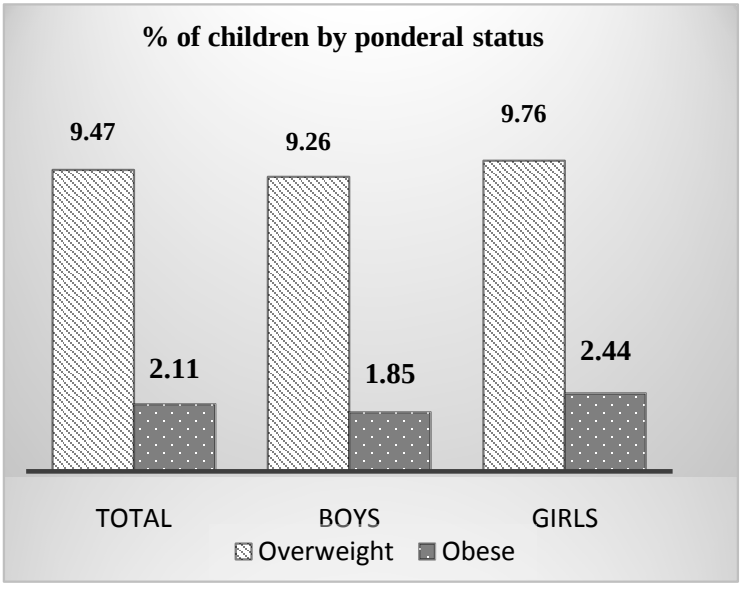

Figure 1. Percentage of children overweighted or obese.

Table 2. Physical Activities and lifestyle of pupils.

Lifestyle and sport	Total (95)		Boys (54)		Girls (40)	
	n	%	n1	%	n2	%
Participation in competitive sport						
Yes	64	68.1	44	81.5	20	50
No	30	32.9	10	18.5	20	50
Time spent for competitive sport/week						
>4 hours	41	65.1	28	65.1	13	65.0
≤4 hours	22	34.9	15	34.9	7	35.0
Physical activities other than sport						
Yes	59	62.1	40	74.1	19	46.3
No	36	37.9	14	25.9	22	53.6
Means of transport						
Foot or bike	82	86.3	44	81.5	38	92.7
Motorbike or car	13	13.7	10	18.5	3	7.3
Duration of locomotion per day						
≥30 min	37	38.9	18	33.3	19	46.3
<30 min	58	61.1	36	66.7	22	53.7
Rest during the day						
Yes	73	76.8	39	72.8	34	82.9
No	22	23,2	15	27.8	7	17.1
Time sitting in front of a media mass						
<3 h	67	70.5	35	64.8	32	78.1
≥3 h	28	29,5	19	35.2	9	21.9

3.4. Eating Habits

Table 3 presents the eating habits of the pupils. It shows that more than half of the pupils like to eat less fat (53%) and less salt (66%). It can also be seen that alcohol and tobacco are almost not part of the pupils' habits, with 94% and 100%, respectively, who did not drink or smoke. The proportion of boys (29%) who eat too much fat is higher than that of girls (17%). The proportion of girls (10%) who liked eating too much salty food was close to that of boys (13%).

3.5. Associations between SBP and Factors Related to Activities and Lifestyle

In the regression analysis, the BMI for Age (Coef = 1.5; $p = 0.016$), participation in competitive sport (Coef = 111.7; $p = 0.000$), were factors associated to SBP while practice and duration of sport were related to DBP. Participation in competitive sport would be associated with high blood pressure (Table 4).

Table 3. Eating habits of pupils.

Eating habits	Total (95) n	%	Boys (54) n1	%	Girls (41) n2	%
Food preference						
Like eating too fatty foods	23	24.2	16	29.6	7	17.1
Like eating less fatty foods	53	55.8	29	53.7	24	58.5
Dislike eating fatty foods	19	20.0	9	16.7	10	24.4
Salt consumption						
Like eating too salty foods	11	11.7	7	13.2	4	9.8
Like eating less salty foods	66	70.2	34	64.1	32	78.0
Dislike eating salty foods	17	18.1	12	22.6	5	12.2
Alcohol consumption						
Yes	06	6.3	4	7.4	2	4.9
No	89	93.7	50	92.6	39	95.1
Tobacco or Cigarette use						
Yes	00	00	00	00	00	00
No	95	100	54	100	41	100

Table 4. Associations between SBP and factors related to activities and lifestyle.

	Coef	Std Err	t	$p > t$	[95% Conf. Interval]	
Diastolic Blood Pressure (DBP)						
Age	0.417	0.311	1.34	0.186	−0.207	1.042
BAZ	0.598	0.411	1.45	0.153	−0.228	1.424
Practice sport	74.854	5.124	14.61	0.000	64.575	85.134
Sex	0.668	1.133	0.59	0.558	−1.604	2.942
Time to practice sport	−4.542	1.132	−4.01	0.000	−6.814	−2.269
Others physical activities	0.638	1.122	0.57	0.572	−1.613	2.890
Means of transport	−0.366	1.581	−0.23	0.818	−3.539	2.806
Walk duration/day	−0.862	1.164	−0.74	0.462	−3.197	1.473
Rest during the day	−0.516	1.221	−0.42	0.675	−2.966	1.934
Sitting in front of a media mass (hour)	−0.192	1.139	−0.17	0.867	−2.477	2.093
Model specification: $p = 0.010$; $R^2 = 0.32$.						
Systolic Blood Pressure (SBP)						
Age	1.092	0.458	2.39	0.021	0.174	2.011
BAZ	1.738	0.605	2.87	0.006	0.523	2.953
Practice sport	95.954	7.533	12.74	0.000	80.843	11.065
Sex	0.642	1.666	0.39	0.702	−2.700	3.984

Continued

Time to practice sport	−0.545	1.665	−0.33	0.745	−3.885	2.794
Others physical activities	−0.649	1.650	−0.39	0.696	−3.959	2.660
Means of transport	−3.527	2.325	−1.52	0.135	−8.191	1.137
Walk duration/day	−0.079	1.711	−0.05	0.963	−3.512	3.354
Rest during the day	−0.583	1.674	−0.32	0.747	−4.185	3.019
Sitting in front of a media mass (hour)	−0.254	1.674	−0.15	0.880	−3.614	3.104
Model specification: $p = 0.0196$; $R^2 = 0.296$.						

Systolic Blood Pressure (SBP); Diastolic Blood Pressure (DBP); BAZ: Body mass index for age.

Children who participate in competitive sports have significantly higher blood pressure (SBP/DBP) than children who do not participate (Coef = 116.7/80.7 mmHg; $p = 0.000$).

The duration of practice per week appeared to be significantly and negatively associated with high blood pressure. Children who practiced more than 4 hours of sport per week had a diastolic blood pressure of less than 4.54 mmHg than those who practiced sport for less than 4 hours ($p = 0.00$; Table 4).

3.6. Associations between DBP/SBP and Factors Related to Eating Habits

Children who like to eat less fat have a lower DBP pressure than those who like to eat a lot of fatty foods (Coef = −2.513; $p = 0.041$); paradoxically, children who like to eat less salt have a higher DBP pressure of 5.280 than children who like to eat a lot of salt. (Coef = 5.284; $p = 0.023$). Alcohol consumption appears to be associated with blood pressure in children (Table 5). Indeed, children who drank alcohol tended to have a systolic blood pressure of 6.14 mmHg higher than children who did not drink alcohol ($p = 0.002$).

4. Discussion

The study objective was to measure the blood pressure profile among secondary school children in North Benin. One of the first studies conducted in an age school population in North Benin, the study has revealed that only one pupil had high blood pressure (blood pressure of 120 to 129 mm Hg systolic and less than 80 mm Hg diastolic). Many studies have shown that high blood pressure is low among adolescent boys and girls in many parts of the world. In a literature review published by Lancet in 2017 (Noubiap et al., 2017), the prevalence of hypertension for 51 studies conducted in Africa during the period 1996-2016, varied from 0.2% to 24.8%. In our study, the prevalence noted is more low (1.05%). This could be explained by the low prevalence of obesity (2.11%) in our sample, as the prevalence of hypertension could be six times higher among obese children than among normal children (Noubiap et al., 2017). Our sample was

Table 5. Eating habits of pupils.

	Coef	Std Err	t	$p > t$	[95% Conf. Interval]	
Diastolic Blood Pressure (DBP)						
Age	0.417	0.311	1.34	0.186	−0.207	1.042
BAZ	0.598	0.411	1.45	0.153	−0.228	1.424
Practice sport	74.854	5.124	14.61	0.000	64.575	85.134
Sex	0.668	1.133	0.59	0.558	−1.604	2.942
Time to practice sport	−4.542	1.132	−4.01	0.000	−6.814	−2.269
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BAZ	1.738	0.605	2.87	0.006	0.523	2.953
Practice sport	95.954	7.533	12.74	0.000	80.843	11.065
Sex	0.642	1.666	0.39	0.702	−2.700	3.984
Time to practice sport	−0.545	1.665	−0.33	0.745	−3.885	2.794
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Systolic Blood Pressure (SBP); Diastolic Blood Pressure (DBP); BAZ: Body mass index for Age.

made from about 62% of children with normal weight status. One would therefore normally expect a lower prevalence of hypertension. Furthermore, this low prevalence could also be due to the small sample size of the study and area study which is a rural area where undernutrition is more prevalent. In studies with sample size more large such as the one conducted in the Uyo Metropolis region of Nigeria with 200 children aged 3 - 17 years, the prevalence of hypertension is about 3.5% (Okpokowuruk et al., 2017). In Northern India, for example, the prevalence of hypertension among rural school children was about 6% (Sharma et al., 2010). Thus, we believe that by replicating this study in urban settings and with a larger sample size, we could obtain a higher prevalence of hypertension in

the general African population because, the prevalence of obesity is increasing among children (Riley et al., 2018).

One of the main risk factors for hypertension is obesity. Although the prevalence of obesity is low, our study corroborates well with studies showing that obesity is one of the risk factors for hypertension. In our study, the BMI-for-age remained significantly associated with the blood pressure profile of children. An increase of one unit of BMI-Age is associated with an increase of 0.59 mmHg for DBP and 1.73 mmHg for SBP. Thus, there is a need to monitor the evolution of this index in school populations to take appropriate public health measures that can reduce the risk in children. Thus, controlling blood pressure in young people early could reduce the prevalence of this disease in adulthood (Litwin, 2018). It is now well documented that children with high blood pressure in childhood and adolescence are at high risk of developing hypertension as adults.

According to WHO, unhealthy diet and physical inactivity contribute to almost 30% of morbidity and mortality from non-communicable diseases, including hypertension (WHO, 2021b). Lifestyle and dietary habits are known to be modifiable risk factors for hypertension. Excessive intake of saturated and trans fatty acids, together with increased salt and sugar consumption and alcohol consumption, are risk factors for cardiovascular diseases including hypertension, according to WHO. Our study showed that preference for fatty foods, salty foods, and alcohol consumption was associated with blood pressure profile in children. Indeed, although we did not accurately measure the amount of salt, fat, or even alcohol consumed, and only preferences were estimated, the data showed a significant association between preferences and blood pressure profile in children. This would confirm the need for dietary and nutritional monitoring of young children at school so that they are not exposed to the type of food that would induce elevated blood pressure later in life. The study has the merit of laying the groundwork for a broad investigation of modifiable risk factors that can be used as a means of prevention among schoolchildren population. Another important factor in the development of hypertension is physical inactivity. We approached the measurement of schoolchildren's lifestyle by collecting information on the practice of sport, other physical activities, the duration of a sport, the means of transport they used, rest during the day, and the 30 min walk recommended by the WHO. Only the practice of sport and the duration of practice among schoolchildren was associated with the blood pressure profile of schoolchildren (systolic/diastolic). In the context of our study, only sport participation seems to be a protective factor for a better blood pressure profile. Children who practice a sport for more than 4 hours per week seem to have lower blood pressure than their counterparts who do not practice or practice for less than 4 hours. These results confirm the already known role of physical activity in the prevention of non-transmissible diseases (Knowles et al., 2013). Further, the study shows that, among young schoolchildren, the practice of a sport discipline at school, such as the sports activities practiced per week, generally on Wednesday evenings and Saturdays in secondary schools in Benin, could be beneficial

for them in reducing the risk of hypertension and especially in the prevention of non-communicable diseases. Further studies are needed to confirm this hypothesis.

Some cautions should be kept in mind when reading the study results. Indeed, this study was conducted in a rural area in the north of Benin, where food insecurity is prevalent. This would partly explain the low prevalence of overweight/obesity. Thus, replication of this study in other areas of Benin or elsewhere where food conditions are better could change the trends. However, this study would have the interest of serving as a reference for others. It would be desirable for the present study to be conducted elsewhere in Benin schools, where the economic conditions of schoolchildren would be better and where obesity would be supposed to be more prevalent (MS, 2016). Also, this study couldn't be generalized to all the pupils of the commune of Pehunco. Nevertheless, the study constitutes a starting point for further investigations in this region.

5. Conclusion

This study revealed that the prevalence of hypertension among a sample of schoolchildren in Pehunco, North Benin was low (1.05%). Protective factors for this low prevalence were found to be the practice of sport for four hours per week, and the low preference for fatty and salty foods by school children. This study underlines the role that sports activities in secondary schools could play in the prevention of non-communicable diseases among schoolchildren. The practice of aerobic sports activities such as swimming, cycling, football, volleyball, handball, etc., which are often in high school programs could be suggested to pupils.

Conflicts of Interest

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

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