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RESEARCH ARTICLE

BLOOD PRESSURE PROFILE AND DIETARY INTAKE OF STUDENTS EXEMPTED FROM PUBLIC GENERAL EDUCATION COLLEGES IN THE COMMUNE OF MISSERETE

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Abstract

Physical education is part of the compulsory curriculum in secondary schools in Benin. Despite being compulsory, it is observed that some students claim to be "exempted" from it in the first weeks of the school year. The main reasons cited, supported either rightly or wrongly by medical authority, include "chest pains during exertion, heart palpitations, dizziness, high blood pressure, health conditions incompatible with physical education for a duration of one year or indefinite, etc.". Thus, faced with an increasingly high rate of exempted students, the dietary consumption of 126 exempted students, including 79 girls and 47 boys from public secondary schools in the commune of Missérété, was analyzed to establish a link with their blood pressure profile. The results revealed that none of the surveyed exempted students from these schools were hypertensive because they have good dietary habits. 45.2% are underweight and 12.6% are overweight or obese. Regarding dietary consumption, none of them consume alcoholic beverages or tobacco. 86.5% walk 2 to more than 3km to school, while 10.3% and 3.2% respectively come by bicycle and motorcycle. In conclusion, the study raised concerns about the sincerity of the statements of all exempted students as well as the certificates issued by medical authority. However, further research is needed to confirm or refute these results.

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Introduction:-

Non-communicable diseases cause over 36 million deaths annually, nearly two-thirds of global mortality, including 17 million deaths from cardiovascular diseases (CVDs). Among these diseases, atherosclerosis is characterized by the deposition of a plaque, known as "atheroma," primarily composed of lipids, on the arterial wall. Over time, these plaques can lead to arterial wall damage, vessel obstruction, or rupture, with often severe consequences. Obesity, particularly induced by a high-fat, low-fiber diet, is a major risk factor for atherosclerosis. Poor-quality diets are identified as the leading cause of disease worldwide. The increasing availability and consumption of low-cost processed foods, characterized by high energy density, contribute to the rising prevalence of obesity and non-communicable diseases. Thus, diet and its impact on the gut microbiota are now areas of interest in cardiovascular research. Numerous studies have concluded that up to 80% of heart diseases and early strokes can be prevented by lifestyle changes, such as adopting a healthy diet and engaging in regular physical activity.

Despite the widely recognized benefits of regular physical activity and healthy eating, there is still reluctance in the school environment regarding the practice of physical education classes. This reluctance is further supported by medical authorities issuing exemption certificates to some students, allowing them to opt out of prescribed activities. Who can determine another's capabilities if not the result of a serious and objective medical examination? Faced with subjectivities observed in the issuance of exemptions, physical education teachers, while remaining skeptical, create barriers not due to pedagogical restrictions but rather as precautionary measures in compliance with regulations. To dispel any skepticism, this study aims to analyze the relationship between blood pressure profiles and dietary consumption among students exempted from public junior high schools in the Missérété commune. To our knowledge, no study has yet examined the situation of students exempted from public junior high schools in this commune.

Materials and Methods:-**Participants**

This was a descriptive, cross-sectional study involving students exempted from public junior high schools in the Missérété commune. A total of 126 exempted students, comprising 79 girls and 47 boys, were selected using non-random sampling and exhaustive selection techniques to participate in the study. They were drawn from nine (09) public Junior High Schools in the Missérété commune, located in the southern part of Benin in the Ouémé department. Inclusion criteria were: being a student exempted from physical education classes and enrolled in one of the nine junior high schools in the commune, holding a waiver signed by a sworn physician from a public health center, and providing informed consent for participation in the study. Students declared fit for physical education classes were not included in the study.

Data Collection**Anthropometric Data**

These data include the height and body mass of each student participating in the study. Height was measured using a SECA wall-mounted stadiometer, France, while the student stood barefoot with heels together, toes slightly apart, body upright, shoulders lowered, back against the stadiometer, head straight, and eyes horizontal. Body mass was measured using a KAMTHRON brand weighing scale, China, with the subject stepping onto it wearing light clothing, eyes fixed forward, and arms hanging down by the sides.

Blood Pressure (SBP, DBP, HR)

Systolic blood pressure (SBP), diastolic blood pressure (DBP), and resting heart rate (HR) were measured using an electronic sphygmomanometer (model SCIAN LD-526, China).

To measure blood pressures (Diastolic and Systolic) and Heart Rate (HR), the student remained seated at rest for at least 15 minutes in a quiet room. The cuff, connected to the sphygmomanometer, was placed on the left arm at heart level. The measurement was then initiated, and the values appeared on the sphygmomanometer screen a few seconds later. These values were taken three (03) times a day for three days in the required calmness to ensure the reliability of the values.

Independent Variables

The independent variables consisted of physical inactivity, body mass index, and dietary habits.

Statistical Analysis

The data were processed using the SPSS software (version 21). Descriptive results are presented as means (m) \pm standard deviation (s). To assess the degree of association between dietary habits and blood pressure profile, Pearson's chi-squared test was performed. Cross-tabulations were also conducted. The significance level for statistical tests was set at $p < 0.05$.

Results:-

Characteristics of Surveyed Exempted Students (n = 126)

Table 1 shows the young age of the subjects with a significantly lower average resting heart rate compared to the theoretical maximum, and mean values of systolic and diastolic blood pressures respectively equal to 97.13 ± 5.20 and 58.62 ± 3.54 mm Hg.

Table 1:- Anthropometric characteristics of surveyed exempted students (n = 126).

	Averages
Age (years)	15.64 ± 2.64
Body Mass (kg)	43.76 ± 9.94
Height (cm)	1.68 ± 0.46
Body Mass Index (kg/cm ²)	20.12 ± 4.93
Systolic Blood Pressure (mm Hg)	97.13 ± 5.20
Diastolic Blood Pressure (mm Hg)	58.62 ± 3.54
RestingHeart Rate (BPM)	98.56 ± 6.44

Blood Pressure Profile and Dietary intake of subjects (n = 126)

χ^2 : degree of association between two variables, P: represents the difference between the two variables ($p < 0.05$)

From the analysis of Table 2, it is observed that all parameters of the blood pressure profile show no significant association, neither with the consumption of salty or fatty foods, nor with that of fruits and vegetables. Due to the low numbers of exempted students consuming salty or fatty foods with or without intake of fruits and vegetables, the study did not reveal any risk of arterial hypertension.

Table 2:- Blood Pressure Profile and consumption of salty Foods, Fatty, Foods, Vegetables, and fruits (n = 126).

	Normal number (%)	Hypotensive number (%)	Hypertensive number (%)	χ^2	P
Consumption of saltyfoods					
Salty	9 (75)	3 (25)	0 (00,00)	2,230	0,398
Lesssalty	91 (89,2)	11 (10,78)	0 (0,00)		
Not salty	11 (91,66)	1 (8,33)	0 (0,00)		
Consumption of fattyfoods					
Fatty	8 (80)	2 (20)	0 (0,00)	0,731	0,724
Lessfatty	93 (88,57)	12 (11,42)	0 (0,00)		
Not fatty	10 (90,90)	1 (9,90)	0 (0,00)		
Consumption of vegetables					
Veryoften	18 (75)	6 (25)	0 (0,00)	5,274	0,200
Often	35 (89,74)	4 (10,25)	0 (0,00)		
Sometime	52 (92,85)	4 (7,14)	0 (0,00)		
Never or rarely	6 (85,71)	1 (14,28)	0 (0,00)		
Consumption of fruits					
Veryoften	27 (90)	3 (10)	0 (0,00)	4,613	0,192
Often	39 (95,12)	2 (4,87)	0 (0,00)		
Sometime	37 (80,43)	9 (19,56)	0 (0,00)		
Never or rarely	8 (88,88)	1 (11,11)	0 (0,00)		

Blood Pressure Profile and Consumption of Alcohol, Tobacco, Sugary Drinks, and Sweets (n = 126)

From the analysis of Table 3, it is evident that concerning the blood pressure profile, the hypertensive modality was not considered since zero hypertensive individuals were observed among the exempted students. The proportion of

hypotensive individuals who never or rarely consume sweets (41.66%) is lower than that of normotensive individuals (58.33%): $p = 0.035$. For all other parameters, the difference between the blood pressure profile and dietary consumption is not significant.

Table 3:- Link between Blood Pressure Profile and Consumption of Alcohol, Tobacco, Sugary Drinks, and Sweets (n = 126).

	Normal number (%)	Hypotensive number (%)	Hypertensive number (%)	χ^2	P
Alcoholconsumption					
Never or rarely	96 (89,71)	11 (10,28)	0 (00,00)	2,615	0,366
Often	3 (75)	1 (25)	0 (00,00)		
Sometimes	12 (80)	3 (20)	0 (00,00)		
Tobacco and cigarette consumption					
Often	0 (00,00)	0 (00,00)	0 (00,00)	-	-
Sometimes	0 (00,00)	0 (00,00)	0 (00,00)		
Never or rarely	111 (88,09)	15 (11,90)	0 (00,00)		
Consumption of sugary drinks					
Veryoften	9 (90)	1 (10)	0 (00,00)		
Often	33 (94,28)	2 (5,71)	0 (00,00)		
Sometimes	55 (84,61)	10 (15,38)	0 (00,00)	2,069	0,516
Never or rarely	14 (87,50)	2 (12,25)	0 (00,00)		
Consumption of sweets					
Veryoften	11 (91,66)	1 (8,33)	0 (00,00)		
Often	38 (88,37)	5 (11,62)	0 (00,00)		
Sometimes	55 (93,22)	4 (6,77)	0 (00,00)		
Never or rarely	7 (58,33)	5 (41,66)	0 (00,00)		

Characteristics of Surveyed Students According to Weight Status, Distance from Home to School, Means of Transportation to School, and Reasons for Exemption.

From the analysis of Table 4, it is evident that 45.2% of exempted students are underweight, while 12.6% are overweight and obese. It is also noteworthy that the proportion of exempted students who walk to school is 86.5%, compared to 10.3% and 3.2% who respectively come by bicycle and motorcycle. Nearly 54.12% and 27.51% of those who walk cover distances of 2 km and then 3 km and above, respectively.

Table4:- Distribution according to weight status, home-school distance, means of transportation, and reasons for exemption (n = 126).

	Number (%)
Weightstatuses	
Underweight	57 (45,2)
Normal weight	53 (42,1)
Overweight	8 (6,3)
Obese	8 (6,3)
Home-school distance (walking)	
1km	20 (18,34)
2km	59 (54,12)
3km and more	30 (27,51)
Means of transportation	
Walking	109 (86,5)
bicycle	13 (10,3)
Motorcycle	4 (3,2)
Reasons for exemption	
Asthma	6 (4,8)
Sicklecelldisease	20 (15,9)
Anemia	4(3,2)

Others	96 (76,2)
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Discussion:-

Validity and Reliability of the Study

All 126 surveyed students were exempted from physical education classes. Each student presented a waiver certificate for the practice of this course, issued by a medical authority from the health center of the communal district. They were selected using the exhaustive selection technique from 09 establishments in the Ouémé department. Therefore, the obtained results are not representative of all students in the Ouémé department, let alone Benin. However, the results remain valid for this population of students, and the collected data can provide useful baseline information on which researchers could rely to undertake a prospective study aiming to determine the existing relationship between blood pressure profile and dietary consumption among exempted students.

Regarding the reliability of the collected data, various measures were taken to ensure its quality. These measures include recruiting and training a team of investigators to understand the questionnaire and its administration, reducing systematic error by having the same individuals administer the questionnaire to the selected subjects.

The Blood Pressure Profile Among Students Exempted from Public Junior High Schools in the Missérété Commune.

Among the exempted students from public junior high schools in the Missérété commune surveyed, none were hypertensive, resulting in a prevalence of 0.00% recorded across the entire sample. These findings differ from the conclusions reached by other studies. In a study on hypertension conducted in the United States, the prevalence of hypertension in children varies between 2.2% and 3.9%, with elevated normal values ranging between 3.4% and 4% [9]. In a systematic review, Bruce A. Kaiser reported that the prevalence in children is less well-known due to regional differences in definitions, reference data in methodology but is estimated to be 4%. Furthermore, a systematic review estimated that the global prevalence of childhood hypertension in 2015 ranges from 4.3% in 6-year-olds to 3.2% in 19-year-olds and peaks at 7.9% in 14-year-olds [10].

Dietary Consumption of Surveyed Exempted Students

The results also indicate that 83.3% and 81.0% of exempted students respectively reported having the habit of consuming foods that are less fatty and less salty. This high observed percentage likely contributed to the absence of hypertensive subjects among the surveyed individuals. Thus, consuming a low-salt diet is a therapeutic measure that has shown a dramatic improvement in blood pressure balance and may therefore represent one of the main tools to avoid the dramatic complications of hypertension and its cardiovascular consequences. Multiple studies have shown that transitioning from excessive to low salt consumption results in a decrease in both systolic (SBP) and diastolic (DBP) blood pressure. This result is achieved after just eight (08) days of salt restriction [11]. It is necessary to reduce intake of saturated fatty acids and trans fatty acids to less than 10% and less than 1% of total energy intake, respectively. Trans fatty acid consumption can be reduced by replacing it with polyunsaturated fatty acids [12].

Furthermore, the role of sodium in the development of high blood pressure and its influence on antihypertensive treatment are well known [13]. According to the WHO (WHO 2013), increased sodium intake is associated with a higher risk of fatal or non-fatal stroke and fatal coronary heart disease, of which hypertension is one of the precursors. In this context, reducing sodium intake in the diet would lead to a decrease in average blood pressure within the population and consequently the prevalence of hypertension. Reducing daily salt consumption by 3 grams would result in a decrease in blood pressure, leading to a 22% reduction in stroke mortality and a 16% reduction in mortality attributable to ischemic heart disease [14]. It is clear that excessive consumption of fatty and salty foods has negative effects on health. The fact that consumption of excessively fatty and salty foods is not part of the dietary habits of these exempted students certainly contributed to maintaining a good level of their blood pressure profile. This likely explains the absence of hypertensive students within this community.

The results indicate that very few students, 7.1% and 5.6% of exempted students respectively, have no preference for consuming fruits and vegetables. Indeed, potassium intake in the diet lowers blood pressure and protects against strokes and cardiac arrhythmias. Potassium intake should be in close proportion to sodium/potassium, meaning a daily potassium intake of 70 to 80 mol. This requires a sufficient daily consumption of fruits and vegetables. The high proportion observed among the surveyed exempted students thus has a positive effect on their blood pressure profile [14].

In the analysis of the results, it is evident that the majority of exempted students have no preference for alcoholic beverages, with a percentage of 85%. Regular alcohol consumption is associated with higher blood pressure values and is a frequent cause of hypertension that is difficult to control [15]. It has been shown that resistance to well-conducted antihypertensive therapy may be linked to excessive alcohol consumption. Decreasing alcohol consumption is likely to reduce high blood pressure and its consequences [16]. It has been noted that the prevalence of high alcohol consumption in a population with essential hypertension ranges from 5 to 7%, indicating that the incidence of alcohol-related hypertension may be higher than other remediable causes of sedentary hypertension. However, the prevalence of hypertension in a population of alcoholic patients is much higher, ranging between 15 and 30% [16]. The positive link between low alcohol consumption and hypertension seems to be present in both sexes, in all races, and appears to be independent of other risk factors, including dietary habits [17].

It emerges from the results of our research that none of the exempted students consume tobacco. This zero percentage of smoking explains the absence of hypertensive students among the subjects. Tobacco consumption promotes an increase in blood pressure. Moreover, it would decrease the effectiveness of most classes of antihypertensive drugs and is often associated with increased alcohol consumption, all contributing to poor blood pressure control in high cardiovascular risk patients [18].

Furthermore, it is noted that over 51.6% stated a preference for sweets compared to 12.7%, and over 46.8% compared to 9.5% regarding candies. This lower proportion of the sample not consuming sweets and candies certainly influences the blood pressure profile of exempted students. An study published in the British Medical Journal shows that added sugars in processed foods are more responsible for hypertension and cardiovascular diseases than salt. The optimal daily salt intake between 3 and 6g could be harmful. Consumption of corn syrup also increases blood pressure, heart rate, and myocardial oxygen demand [19].

From all the above, it is crucial to reject the first hypothesis formulated. However, the second one remains to be verified because the good nutrition of the subjects does not justify the absence of hypertension (HTN) among them. More specifically, are there other factors that could explain the absence of HTN among the subjects? Does the current dietary profile of the subjects guarantee them a risk-free blood pressure profile?

Link between Blood Pressure Profile and Dietary Consumption of Exempted Students

The results of the data collection show, on the one hand, that the foods consumed by the students do not affect their blood pressure profile. However, the consumption of candies seems to affect hypotensive students; since the research does not go in this direction, no further clarification could be provided at this level.

On the other hand, the results obtained regarding weight status show that only 6.3% of the surveyed students are obese or overweight. It is important to note that obesity and overweight are recognized as risk factors for HTN. The prevalence of HTN among individuals with normal BMI according to studies generally ranges from 20 to 30%, while it is higher than 40% among those who are overweight or obese [20]. Obese individuals are at higher risk of developing HTN. Similarly, overweight and obesity are often associated with the presence of HTN [21]. Weight reduction in obese individuals with overweight could contribute to lowering blood pressure. According to a study conducted in Algeria, the percentages of pre-hypertensive adolescents and hypertensive adolescents were respectively 13.0% and 12.4% among overweight adolescents, 5.9% and 31.4% among obese adolescents, and 12.9% and 10% among those of normal weight [13]. It is therefore clear that there is a proportional link between weight status and blood pressure profile. Thus, despite the absence of hypertensive individuals in the sample, some members are at risk of HTN due to their weight status. It is also important to note that this risk of HTN is especially significant with sedentary lifestyle and other coexisting diseases among the exempted students. Lastly, the second hypothesis could be confirmed if the sample had included hypertensive individuals. Nevertheless, it must be concluded that the good nutrition of the students protects them from HTN, which is nevertheless not far away due to their "exempted" status.

Conclusion:-

The aim of this study was to establish the relationship between blood pressure profile and dietary consumption among students exempted from public junior high schools in the municipality of Missérété. The results revealed that exempted students do not suffer from hypertension. This observation could be explained by the fact that all these students engage in physical activities by walking or cycling to attend other classes besides physical education (PE) for which an exemption certificate has been issued to them.

Furthermore, the study found that the absence of hypertensive students among the exempted students could be justified by a good dietary consumption adopted by these students. However, the status of exempted student leads some of them to sedentarism and exposes them to overweight and/or obesity, which are risk factors for hypertension.

Thus, these results demonstrate that exempted students from public junior high schools in the municipality of Missérété, who adopt a healthy diet, have blood pressure profiles conducive to participating in PE classes.

Study Limitations

The sphygmomanometer used during the study alone cannot assess the diseases mentioned as reasons for exemption of students, such as asthma, sickle cell disease, and other illnesses (76%) sometimes related to each exempted student's personal preferences. However, it has the merit of revealing that students presumed to be exempted from PE classes are actually engaging in this course. This does not in any way affect the reliability of the results obtained regarding cardiovascular diseases generally cited by students to justify exemption from PE classes.

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