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Variation in Blood Glucose and Blood Pressure Distribution among Students of a Tertiary Institution in Port-Harcourt

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Globally, reports on diabetes, hypertension and other cardiovascular diseases have shown to pose a major pitfall of health challenge, resulting in mortality especially among middle and low-income groups in developing countries**.**
Aim: This research was therefore undertaken to determine the variation in blood glucose and blood pressure distribution among individual students of a tertiary institution in Port-Harcourt, Nigeria.
Methodology: This is a randomized cross sectional observational study. 220 apparently healthy students (54 male and 166 female) of Rivers State College of Health Sciences and Management Technology (RIVSCOHSMAT), Port Harcourt were recruited into the study, Fasting blood glucose and blood pressure were determined using glucometer and sphygmomanometer respectively.
Results: The results show the prevalence of prehypertension and hypertension as 8.2% and 10.5% respectively. The results revealed that 2.3% of the population was pre-diabetic with a higher prevalence in men (5.6%) compared to females (1.2%). Male subjects had significantly higher fasting blood sugar, systolic, diastolic and mean arterial blood pressure compared to the females ($p<0.05$).

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Conclusion: The study revealed gender differences in blood glucose homeostasis between women and men. More awareness is needed to encourage a healthier lifestyle to reduce the burden of diabetes and hypertension.

Keywords: Blood glucose; blood pressure; cardiovascular; hypertension; gender.

1. INTRODUCTION

Blood glucose shows a degree of glucose in venous, arterial and capillary blood [1,2].Glucose is a monosaccharide sugar which the body obtains from the food we eat and remains a principal and universal energy source for every organism where it fuels both aerobic and anaerobic cellular respiration [3]. Glucose homeostasis is tightly coupled with the balance of two major hormones, insulin and glucagon [4]. While insulin promotes the uptake of glucose into cell due to high glucose levels in the blood, glucagon promotes the release of glucose into the blood by gluconeogenesis and glycogenolysis [1,2]. Blood pressure represents the pressure which is measured within large arteries of the systemic circulation hence often referred to as systemic arterial pressure [5].This pressure is commonly divided into systolic blood pressure (SBP) which is the maximum pressure when the heart contracts to pump blood and diastolic blood pressure (DBP) which is the lowest pressure when the heart relaxes between its beatings[6].

Prehypertension is an intermediate status between normal blood pressure and hypertension, [7] while prediabetes is defined as a metabolic status between normal blood glucose and diabetes mellitus [8].

WHO reports that hypertension and other cardiovascular diseases constitute a major form of public health challenge and death globally where it continues to consume a significant proportion of their health budget [9,10]. In most countries, this condition affects about 20% of adults, and accounts for 20 to 50% of all deaths [9]. Also, the World Health Organization (WHO) estimates that 1.6 million people died of diabetes each year with this figure found majorly among the lower income countries[10,11] [12] [13]. In the light of emerging life style modifications and public awareness with regards to hypertension and diabetes, it has become imperative to continually conduct population based studies so as to update and provide population based data. This study is therefore an attempt to evaluate the variation in blood glucose and blood pressure distribution among students of a tertiary institution in Port-Harcourt, Rivers State, Nigeria with a view to determining the possible association that exists among them.

2. MATERIALS AND METHODS

This study is a randomized cross sectional observational study.

2.1 Sampling Methods

A total of 220 students were selected from the college via multistage sampling technique.

2.1.1 First stage

Five (5) out of 10 schools in the college were selected by simple random sampling.

2.1.2 Second stage

One (1) department from the preselected schools was selected.
Total of 5 departments were selected namely: Community Health, Dispensing Optician, Emergency Medical Technician, Health Information Management and Medical Social Work department.

2.1.3 Third stage

Forty four (44) participants were finally selected from each of the 5 preselected departments namely: Community Health, Emergency Medical Technician, Dispensing Optician, Health Information, Management and Medical Social Work department.

2.2 Study Protocols

The target population for this study consisted of all students of Rivers State College of Health Science and Management Technology (RIVSCOHSMAT), Port Harcourt.

2.2.1 Inclusion criteria

The inclusion criteria for the study include;

- ✓ Students from same institution (Rivers State College of Health Science and Management Technology)
- ✓ Consenting adults between 20-49 years
- ✓ Young adults that do not have any health disorders.
- ✓ Physically and mentally healthy subjects

2.2.2 The exclusion criteria include

- ✓ Students from a different institution
- ✓ Young adults less than 20 years with health challenge.
- ✓ Mentally unstable
- ✓ All students who were absent during data collection
- ✓ Students who had already taken their breakfast
- ✓ Students who didn't give their consent during recruitment
- ✓ Students who were found physically handicapped with both lower limbs affected

2.3 Sample Size/Sampling Technique

Sampling of participants was done in the College. A sample of 220 was selected using Population Proportion – Sample Size formula [14] to calculate the size of the sample for an estimated population of healthcare students as follows:

$$n = N*X / (X + N - 1)$$

Where,

$$X = Z_{\alpha/2}^2 * p*(1-p) / MOE^2$$

and

$Z_{\alpha/2}$ = critical value of the Normal distribution at α/2
MOE = the margin of error
p = sample proportion
N = population size

Using

$Z_{\alpha/2}$ = 1.96
MOE = 5%
p = 50%
N = 500

X is therefore obtained as 384 while sample size **n** is obtained as 218. This was however rounded up to 220.

2.4 Data Collection

Recruited students from each pre-selected department were gathered at the practical demonstration hall of the department of Community Health on each day of meeting. Each department met in two days; on each first day of meeting they were briefed on what the study entails. They were instructed to take their last meal at night before going to bed and do an all-night fast, and return fasting the following day between the hours of 8am to 10am for the study to avoid the specific dynamic action of food on Blood Sugar level determination. On each second day of meeting, only those that complied with the advice (overnight fasting) were eligible for the study, information regarding their age, sex and tribe were obtained using respondents identification card with Serial Number 1-220 (S1……..S220) constructed by the researcher.

2.5 Blood Pressure

The measurement of the blood pressure was done by manual methods using a mercury sphygmomanometer (Accoson®) and a Littmann® stethoscope. The subjects were allowed about 5 minutes of rest before the commencement of the procedure. The Blood pressure was taken on the left arm with each participant in a sitting position. The cuff of sphygmomanometer was rapidly inflated as it tightly applied around the upper arm at about 2.5cm above the ante-cubital fossa. The inflation was stopped at the point where the radial pulse was no longer palpable on the stethoscope. The cuff was then slowly deflated as the stethoscope is placed over the brachial artery in the ante-cubital fossa. The onset of the first sound was taken as the systolic pressure and the instance where the sound completely disappears was taken as the diastolic pressure [5] [6].

2.6 Fasting Blood Glucose (FBG)

FBG of each subject was determined using Accu-Chek Glucometer Active (Roche, Germany).

2.7 Statistical Analysis

Statistical Package for Social Sciences version 11 (SPSS Inc., Chicago, USA) was used for data analysis. A p value of <0.05 was considered to be statistically significant.

3. RESULTS AND DISCUSSION

3.1 Demographic Distribution of the Study Population (Table 1)

Shows the distribution of the demographics of the study population in relation to gender, age, tribe, blood pressure and fasting blood sugar. It shows that more females (53.3%) were involved in the study compared to males (36.3%) with population of the study predominantly of the youthful population (20-29yrs and 30 – 39yrs). The study population comprised majorly of the Ijaw tribe (43.6%) compared to other major tribes of Hausa, Igbo, Yoruba and Ikwere. The blood pressure and fasting blood glucose obtained were within normal range at 81.4% and 97.7% respectively.

3.2 Blood Pressure and Fasting Blood Sugar of the Study Population (Table 2)

Shows a comparison of the blood pressure and fasting blood sugar of male and female subjects in the study population. The results show that the males had a significantly higher mean values for systolic blood pressure, mean arterial blood pressure ,diastolic blood pressure and fasting blood sugar, compared to the female subjects ($p<0.05$).

3.3 Age Classification, Blood Pressure and Fasting Blood Sugar of the Population of Study (Table 3)

Shows the age distribution of blood pressure and fasting blood glucose of respondents. No significant difference was observed with regards to age; however, the respondents showed higher systolic pressure reading/value.

3.4 Tribal Classification of Blood Pressure and Fasting Blood Sugar of the Study Population (Table 4)

Shows a tribal distribution of the blood pressure and fasting blood pressure of the population of the study. There wasn't any observable significant difference in the values of all the parameters considered ($p>0.05$).

In this research, the blood pressure and fasting blood Glucose of 220 apparently healthy subjects made up of students of Rivers State College of Health Science and Management Technology (RIVSCOHSMAT), Port Harcourt were determined.

The results show the demographics of the study population relating to gender, age, tribe, blood pressure and fasting blood glucose. It shows that there were more females (53.3%) than males (36.3%) with a higher number of the youthful population (20-29yrs and 30 – 39yrs). The respondents comprised majorly of the Ijaw tribe (43.6%) compared to other major tribes of Hausa, Igbo, Yoruba and Ikwerre. The respondents' were mostly classified as normal with their blood pressure (81.4%) and fasting blood glucose (97.7%). The results as shown in table 4.2 revealed an insignificant difference in the age of the male and female subjects ($P>0.05$).

Table 1. Demographic distribution of the Study Population

Variable	Category	Gender		Total Population
		Male n(%)	Female n(%)	n(%)
Age	20-29yrs	29(53.7)	89(53.6)	118(53.3)
	30-39yrs	20(37.0)	60(36.6)	80(36.4)
	40-49yrs	5(9.3)	17(10.2)	22(10.0)
Tribe	Hausa	6(11.1)	10(6.0)	16(7.3)
	Igbo	9(16.7)	57(34.3)	66(30.0)
	Yoruba	0(0.0)	17(10.2)	17(7.7)
	Ikwere	8(14.8	17(10.2)	25(11.4)
	Ijaw	31(57.4)	65(39.2)	96(43.6)
Blood Pressure	Normal	35(64.8)	144(86.7)	179(81.4)
	Pre-hypertension	6(11.1)	12(7.2)	18(8.2)
	Hypertension	13(24.1)	10(6.0)	23(10.5)
Fasting Blood Glucose	Normal	51(94.4)	164(98.8)	215(97.7)
	Pre-diabetes	3(5.6)	2(1.2)	5(2.3)

Results are given as mean ± standard deviation (range)

Table 2. Blood pressure and Fasting Blood Glucose of the study population

Parameters	Male (n=54)	Female (n=166)	t-Test Significance
Systolic Blood Pressure (mmHg)	114.35±15.59 (79-167)	109.91±12.06 (60-150)	p=0.03*
Diastolic Blood Pressure (mmHg)	76.17±14.99 (40-101)	70.9880±10.92 (40-101)	p=0.01*
MAP (mmHg) mean arterial pressure	88.46±11.09 (68.00-120.70)	84.09±9.48 (60.00-112.30)	p=0.04*
Fasting Blood glucose (mmol/L)	4.45 ±0.73 (2.80-6.30)	4.12±0.70 (2.60-7.00)	p=0.01*

Results are given as mean ± standard deviation (range)

Table 3. Age Classification, Blood Pressure and Fasting Blood Glucose of the Population of Study

Parameters	20-29yrs (n=118)	30-39yrs (n=80)	40-49yrs (n=22)	ANOVA Significance
Systolic Blood Pressure (mmHg)	110.15±12.32 (79-160)	111.94±13.93 (60-167)	112.14±14.54 (82-140)	p=0.59
Diastolic Blood Pressure (mmHg)	70.88±12.52 (40-101)	74.24±12.04 (40-101)	72.64±10.36 (60-100)	p=0.17
MAP (mmHg) mean arterial pressure	84.56±11.15 (60.00-120.700	85.96±8.95 (63.30-105.30)	85.53±7.42 (73.30-100.30)	p=0.62
Fasting Blood Glucose (mmol/L)	4.26±0.77 (2.80-7.00)	4.16±0.71 (2.60-6.40)	4.17±0.50 (3.3000-5.50)	p=0.61

Results are given as mean ± standard deviation (range)

Table 4. Tribal classification of blood pressure and fasting blood glucose of the study population

Parameters	Hausa (n=16)	Igbo (n=66)	Yoruba (n=17)	Ikwerre (n=25)	Ijaw (n=96)	ANOVA Significance
Systolic Blood Pressure (mmHg)	108.50±6.88 (100-120)	113.53±11.40 (100-143)	105.65±9.44 (83-124)	114.60±16.99 (84-167)	109.69±14.01 (60-160)	p=0.07
Diastolic Blood Pressure (mmHg)	74.56±13.24 (60-167)	73.70±11.40 (60-101)	67.18±9.41 (60-100)	71.75±12.93 (59-100)	72.26±12.92 (42-80)	p=0.33
MAP (mmHg) mean arterial pressure	86.49±12.79 (70.70-120.70)	86.05±9.82 (60.00-112.30)	81.67±7.25 (61.70-90.0)	84.57±9.25 (61.30-98.70)	85.11±10.37 (60.00-112.30)	p=0.57
Fasting Blood Glucose (mmol/L)	4.41±0.90 (3.50-5.90)	4.10±0.72 (2.60-7.00)	4.10±0.83 (3.20-5.20)	4.18±0.57 (3.20-5.20)	4.30±0.75 (3.10-6.40)	p=0.31

Results are given as mean ± standard deviation (range)

The result of the study revealed that 2.3% of the study populations were pre-diabetic with a higher prevalence in men (5.6%) in relation to the females (1.2%); This could have been due to some life style factors including obesity, physical activity, diet, stress and urbanization amongst other causes. The mean values of fasting blood sugar was found to be significantly higher in men compared to the female subjects ($p<0.05$). Previous researches reveal gender differences in blood glucose homeostasis between women and men [15,16].Though the precise mechanism for this gender difference is unclear, scientists generally belief that gonadal hormones play a significant part since estrogen enhances glucose homeostasis before menopause while this ability is impaired after menopause [17]. It has also been observed that insulin resistant is sex dependent. This is because insulin level increases in women due to higher glucose deposit in their skeleton than in men [18]. In other studies, men have been observed to have a higher fasting blood glucose compared to women [19,20].

The respondents were observed to be pre-hypertensive (8.2%) and hypertensive (10.5%) using WHO standard for the classification of blood pressure (WHO, 2013). This is slightly lower than previously reported crude prevalence for hypertension in adult Nigerian populations [21,22,23]. The results indicate that males had a significantly higher mean values for diastolic blood pressure, systolic blood pressure and mean arterial blood pressure when compared to the female subjects ($p<0.05$). Studies have shown that men have a greater tendency to develop cardiovascular risk complications than women which is attributable to the impact of testosterone on men which tends to increase their blood pressure starting at puberty [24]. It was observed that there was a gradual increase in the mean values of systolic, diastolic and mean arterial pressure across the age groups ($p<0.05$) with the oldest age group (40-49yrs) having the highest mean values while the youngest age group (20-29) had lowest. Studies have also revealed that age- related increase variations in blood pressure has remained an integral part of the process of human aging [25]. It has also been opined that age related variations in level of adiposity, physical activity, diet and psychological stress has significant role to play [26,27]. The thickening of arterial walls and a decrease in baroreceptor sensitivity caused by age are major physiological factors accountable for the inevitable rise in blood pressure with increasing age [28]. Previous studies also documented increase in blood pressure with age among Nigerian adult populations [29].

4. CONCLUSION

This study has therefore reported the blood pressure and fasting blood sugar of apparently healthy students of Rivers State College of Health Science and Management Technology (RIVCOHSMAT) and concludes that age is a predictor of cardiovascular diseases among adult populations therefore; more awareness is needed to encourage a healthier lifestyle to reduce the burden of diabetes and hypertension.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

The nature, purpose and procedure of the research were explained to the respondents after which written consent was obtained from those who agreed to participate in the study. Respondents were given the chance to freely decide to partake in the study if they so desired and were assured of anonymity of information provided hence identification numbers were used instead of their names, and as many that gave their consent were recruited for the study until the sample size was reached.

ETHICAL APPROVAL

Ethical approval was obtained from the relevant ethical committees including the University of Port-Harcourt ethical committee. An introduction letter was also obtained from the Department of Human Physiology and was shown to the Authority at RIVSCOHSMAT for permission to carry out the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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