

Original Research Article

VARIATION IN BLOOD GLUCOSE AND BLOOD PRESSURE DISTRIBUTION AMONG STUDENTS OF A TERTIARY INSTITUTION IN PORT-HARCOURT

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 sugar and blood pressure were determined using manual methods and a glucometer respectively.

Results: The results show the prevalence of prehypertension and hypertension was found to be 8.2% and 10.5% respectively. Male subjects had significantly higher fasting blood sugar, systolic, diastolic and mean arterial blood pressure compared to the females ($p < 0.05$).

Conclusion: Age indeed is a predictor of cardiovascular and metabolic diseases. More awareness is needed to encourage a healthier lifestyle to reduce the burden of diabetes and hypertension.

KEYWORDS: blood glucose; blood pressure; cardiovascular; hypertension; institution.

Comment [AME1]: What is the general prevalence of Diabetes mellitus in the study.

Comment [AME2]: Institution is not a scientific word. Kindly replace.

INTRODUCTION

Blood sugar refers to the precise quantity of glucose found in the 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].

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. In most countries, this condition affects about 20% of adults, and accounts for 20 to 50% of all deaths [7]. Also, the World Health Organisation estimates that 1.6 million people died of diabetes each year with this figure found majorly among the lower income countries [8] [9] [10] [11]. 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.

Comment [AME3]: Blood sugar is different from blood glucose and this definition is not correct. Kindly correct accordingly.

Comment [AME4]: Kindly cite authority.

MATERIALS AND METHODS

This study is a randomized cross sectional observational study.

Sampling Methods

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

First stage

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

Second stage

One (1) department from the preselected schools was selected.

Total of 5 departments were selected namely: Community Health, Dispensing, Emergency Medical Technician, Health Information Management and Medical Social Work department.

Comment [AME5]: Dispensing what?

Third stage

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

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.

Inclusion criteria

The inclusion criteria for the study include;

- ✓ Human subjects
- ✓ Students from same institution (Rivers State College of Health Science and Management Technology)

Comment [AME6]: Human subject cannot be an inclusion criteria because your topic already said students because animals cannot be students.

- ✓ **Consenting teenagers and adults.**
- ✓ Young adults that do not have any health disorders.
- ✓ Physically and mentally healthy subjects

Comment [AME7]: Kindly define your age bracket for the study.

The exclusion criteria include;

- ✓ Non-human subjects
- ✓ Students from a different institution
- ✓ Young adults that have any 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

Comment [AME8]: Kindly reframe your inclusion and exclusion criteria.

Sample Size/Sampling Technique

Sampling of participants was done in the College. A sample of 220 was selected using Population Proportion – Sample Size formula [12] 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 $\alpha/2$

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.

Comment [AME9]: How did you arrived at this. Kindly show your workings. Also, what was the prevalence used for this calculation.

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 (starving overnight) 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.

Comment [AME10]: Overnight fasting

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.

Comment [AME11]: Cite authority.

Fasting Blood Glucose: FBG of each subject was measured using Accu-Chek^(R) Active (Roche, Germany).

Comment [AME12]: One blood glucose test is not enough to declare anyone diabetic. Also, rapid glucose check using acucheck is not a standard method.

Ethical Consideration

Ethical approval and clearance was sought and obtained from 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. 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.

Comment [AME13]: Since the study is being done in the city of Port Harcourt, I think ethical clearance would have being gotten from Ministry of Health, Port-Harcourt.

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.

RESULTS AND DISCUSSION

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 sugar of the subjects were mostly classified as normal at (81.4%) and (97.7%) respectively.

Comment [AME14]: Review

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 ($p < 0.05$).

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 sugar of the study population. None of the parameters showed any significant trend with age however, it was observed that there exists a slight increase in the systolic pressure of the study population with the various age groups ($p > 0.05$)

Comment [AME15]: Which group is the study population. Kindly review your write-up.

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 ($p > 0.05$).

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 Sugar	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 \pm standard deviation (range)

Table 2: Blood pressure and Fasting Blood Sugar of the study population

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

Results are given as mean \pm standard deviation (range)

Table 3: Age Classification, Blood Pressure and Fasting Blood Sugar 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)	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 Sugar (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 sugar 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)	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 Sugar (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)

In this research, the blood pressure and fasting blood sugar 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 sugar. 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 sugar (97.7%). The results as shown in table 4.2 revealed an insignificant difference in the age of the male and female subjects ($P>0.05$).

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%). 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 [13] [14]. Though the precise mechanism for this gender difference is unclear, scientists generally believe that gonadal hormones play a significant part since estrogen enhances glucose homeostasis before menopause while this ability is impaired after menopause [15]. 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 [16]. In other studies, men have been observed to have a higher fasting blood glucose compared to women [17] [18].

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 [19] [20] [21]. 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 [22]. 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 [23]. It has also been opined that age related variations in level of adiposity, physical activity, diet and psychological stress has significant role to play [24] [25]. 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 [26]. Previous studies also documented increase in blood pressure with age among Nigerian adult populations [27] [28].

Comment [AME16]: The information in the discussion should be synchronise properly and relate to previous work to make meaning.

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.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. 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.

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UNDER PEER REVIEW

