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RESEARCH ARTICLE

EVALUATION OF BODY MASS INDEX,WAIST CIRCUMFERENCE, URINE ELECTROLYTES, FASTING BLOOD SUGAR AND BLOOD PRESSURE IN STUDENTS IN NNEWI

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ABSTRACT

Background of Study: Abnormal increase in fasting blood sugar, blood pressure, waist circumference, body mass index and some electrolytes are known to increase the risk of early cardiovascular event.
Aim and Objectives: This study investigated the relationship between blood pressure, anthropometric variables, urine electrolytes and fasting blood sugar in students of College of Health Sciences, Nnewi.
Material and Methods: A total of fifty (50) students were recruited in the study. All the parameters were measured using standard methods.
Results: Results obtained were subjected to statistical analysis and results presented as mean±SD. The results show that the male subjects have a significantly lower ($P<0.05$) waist circumference and higher systolic blood pressure ($P<0.05$) compared to the female subjects. There was also a positive and significant correlation between urine potassium and systolic blood pressure ($P=0.015$) and diastolic blood pressure ($P=0.04$) in the male subjects.
Conclusion: The results show that fasting blood sugar did not significantly correlate with all the parameters in both subjects. It can be concluded that the subjects' waist circumference and systolic blood pressure could be the major predisposing factors to the subjects having cardiovascular diseases.

INTRODUCTION

Blood Pressure (BP) is the pressure of circulating blood on the walls of blood vessels. It usually refers to the pressure in large arteries of the systemic circulation. Blood Pressure is usually expressed in terms of the systolic pressure over diastolic pressure and is measured in millimeters of mercury (mmHg), above the surrounding atmospheric pressure (considered to be zero). It is one of the vital signs, along with respiratory rate, heart rate, oxygen saturation, and body temperature. Normal resting blood pressure in an adult is approximately 120 millimeters of mercury(16 kPa) systolic, and 80 millimeters of mercury (11 kPa) diastolic, abbreviated "120/80 mmHg". Traditionally, blood pressure was measured non-invasively using a mercury sphygmomanometer and this is still generally considered the gold standard (Ogedegbe, 2010). Blood pressure is influenced by cardiac output and varies depending on situation, emotional state, activity, and relative health/disease states.

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Blood pressure that is low due to a disease state is called hypotension, and pressure that is consistently high is hypertension. Long term hypertension is a risk factor for many diseases, including heart disease, stroke, and kidney failure. The risk of cardiovascular disease increases progressively above 115/75 mmHg (Appel, 2006). In practice blood pressure is considered too low only if noticeable symptoms are present. In the UK, clinic blood pressures are usually categorized into three groups; low (90/60 or lower), normal (between 90/60 and 139/89), and high (140/90 or higher). Blood pressure fluctuates from minute to minute and normally shows a circadian rhythm over a 24-hour period, with highest readings in the early morning and evenings and lowest readings at night. Loss of the normal fall in blood pressure at night is associated with a greater future risk of cardiovascular events than day-time blood pressure (Hansen, 2010). Also, an individual's blood pressure varies with exercise, emotional reactions, sleep, digestion and time of day (circadian rhythm). Various other factors, such as age and sex, also influence a person's blood pressure. As adults age, systolic pressure tends to rise and diastolic pressure tends to fall (Pickering, 2005). Consequently, in the elderly, systolic blood pressure often exceeds the normal adult range (Pickering, 2005), this is thought to be due to increased stiffness of the arteries (Franklin, 2008). Differences between the left and right arm blood pressure measurement tend to be small. However, occasionally there is a consistent difference greater than 10mmHg which may need further investigation, e.g. for obstructive arterial disease (Eguchi, 2007).

More so, the body mass index (BMI) also known as Quetelet index is a value derived from the mass (weight) and height of an individual. The BMI is defined as the body mass divided by the square of the body height, and is universally expressed in units of kg/m^2, resulting from mass in kilograms and height in meters. The BMI is an attempt to quantify the amount of tissue mass (muscle, fat and bone) in an individual, and then categorise that person as an underweight, normal weight, overweight, or obese based on that value. BMI provides a simple numeric measure of a person's thickness or thinness. BMI was designed to be used as a simple means of classifying average sedentary (physically inactive) populations, with an average body composition (WHO, 1995). Additional metrics, such as waist circumference, can be more useful. The current value recommendations are as follows: a BMI from 18.5 up to 25 kg/m^2 may indicate optimal weight, a BMI lower than 18.5 suggests the person is underweight, a number from 25 to 30 may indicate the person is overweight, and a number from 30 upwards suggests the person is obese (National Heart, 2014).

Urinary electrolytes in turn are used in the diagnosis of a number of electrolyte disturbances in intensive care unit. A normal individual will consume about 150-200 mmol of sodium every day. In states of abnormal sodium wasting (eg. Hypoaldosteronism), urinary sodium will be high as the mechanisms of normal sodium conservation are impaired and this leads to hyponatremia (low sodium). Urinary chloride levels distinguish between renal and extrarenal causes of metabolic alkalosis (Mersin, 1995). The essence of urinary potassium is in the diagnosis of hypokalemia. The normal response to hypokalemia is to excrete less potassium and to increase its reabsorption from the tubular lumen. In cases of gastrointestinal loss of potassium, the urine potassium will be low. Decreased levels of urine potassium are also seen in hypoaldosteronism and adrenal insufficiency. Urinary sodium, together with assessment of volume status, is useful in the differential diagnosis of hyponatraemia. Urinary chloride excretion during steady state conditions will reflect ingested chloride which predominantly is in the form of sodium chloride (NaCl). However, under certain clinical conditions, the renal excretion of chloride may not reflect intake. For instance, during states of extracellular volume depletion, urine chloride (and sodium) excretion is reduced.

According to the National Institutes of Health (NIH), (National Heart, 1998) a high Waist Circumference (WC) is associated with an increased risk for type 2 diabetes, dyslipidemia, hypertension and cardiovascular disease when the BMI is between 25 and 34.9. Waist circumference is commonly used to assess abdominal obesity and has been established as a predictor of increased morbidity and mortality independent of body mass index (Janssen, 2004). Changes in waist circumference over time can indicate an increase or decrease in abdominal fat. For most adults, a waist circumference of greater than 94cm for men and 80cm for women is an indicator of the level of internal fat deposits which coat the heart, kidneys, liver, digestive organs and pancreas. This can increase the risk of heart disease and stroke. Visceral fat in particular appears to be associated with insulin resistance which leads to type 2 diabetes. Visceral fat is also associated with adverse lipid profiles which in turn predispose to cardiovascular disease. Individuals with increased waist circumference levels are more likely to have hypertension, type 2 diabetes and dyslipidemia, than those with normal WC status irrespective of weight status (Janssen, 2002). Determining an individual's waist circumference measurement helps to target treatment towards, particularly at-risk patients who have a tendency to store excess weight centrally (Despres, 2001). For this reason, waist circumference measurement is increasingly recognized.

Furthermore, fasting blood sugar (FBS) measures blood glucose after about 8 hours fast. It is often the first test done to check for pre-diabetes and diabetes. Fasting blood sugar provides vital clues about how the body is managing blood sugar levels. Blood sugar tends to peak about an hour after eating, and declines after that. High FBS levels point to insulin resistance or diabetes. Abnormally low FBS could be due to diabetes medications. Normally, as blood sugar rises, the pancreas releases insulin. Insulin lowers blood sugar, breaking it down so that the body can use it for energy or store it for later. However, people who have diabetes have difficulties with insulin. People with type 1 diabetes do not produce enough insulin because the body attacks insulin-producing cells while people with type 2 diabetes do not respond well to insulin. In both cases, the result is same: elevated blood sugar levels. Both high and low blood sugar levels can cause loss of consciousness or seizure if left untreated. A normal FBS result should be between 3.9 to 5.5 mmol/L (70 to 100mg/dl). Indeed, high blood pressure is becoming a major health issue in the society both in adults and more recently in the young population. Habitual salt intake has been implicated in the aetiopathogenesis of hypertension for decades (Despres, 1989). Assessment of urine electrolytes and some anthropometric parameters may be of utmost relevance in evaluating the disposition of the subjects to cardiovascular diseases.

Study Site

The subjects for this study were recruited from the students of College of Health Sciences and Technology, Nnamdi Azikiwe University, Nnewi, Anambra State, Nigeria.

Study Design

This is a cross sectional study designed to assess some anthropometric variable in relation to urine electrolytes and fasting blood sugar among students of College of Health Sciences, Nnewi campus. They were randomly recruited after an informed consent. The subjects comprise 25 males and 25 females between 18-25 years. For each subject, two milliliters (2mls) of early morning urine sample was collected in a plain plastic sample container. Their sex, weight, height, waist circumference and blood pressures were taken. The urine samples were taken to the laboratory for analysis. For the fasting blood glucose, two drops of blood from the ball of the middle finger was collected before the subjects took their breakfast. Urine electrolytes were determined using Ion selective electrode, whereas blood glucose was estimated using glucose oxidase method as described by Amir *et al*. (2005), Waist circumference was measured using the method described by National Institutes of Health- (NIH) (National Heart, 1998).

Statistical Analysis

Data was analyzed using Statistical Package for Social Sciences (SPSS) version 21.Comparison of measured variables between groups was by one-way analysis of variance (ANOVA) while independent t-test was used to compare between groups. Values of P<0.05 were considered statistically significant. Results were presented as mean±SD. Correlation of the parameters was determined using Pearson's correlation coefficient.

RESULT

Table 1 shows the mean and standard deviation of the anthropometric variables, fasting blood sugar and the urine electrolytes. The table shows the mean values of waist circumference as 82.79 which fall within the normal reference range of not more than 80cm for women and not more than 94cm for men.

The mean values of BMI being 23.91 falls within the normal reference range which is 18.5-25 kg/m^2. Also, the mean values of diastolic blood pressure (80.06) presented on the table also falls within the normal range which is 90-140mmHg and 60-90mmHg respectively. For the urine electrolytes; sodium, potassium and chloride with mean values of 264.89, 60.00, 246.93 mmol/L respectively also falls within the normal ranges which are 51-286mmol/L, 25-125 mmol/L and 140-250 mmol/L respectively. Therefore, the mean and standard deviation for all the parameters are within the normal ranges for all the general subjects.

Table 1. Mean Anthropometric Variables, Fasting Blood Sugar and Urine Electrolytes of the Subjects

Parameters	N	Mean	Std. Deviation
WC (cm)	50	82.79	12.72
Weight (kg)	50	68.24	17.84
Height (m)	50	1.69	0.11
BMI (kg/m^2)	50	23.91	5.62
SBP (mmHg)	50	128.14	19.32
DBP (mmHg)	50	80.06	10.63
FBS (g/dl)	50	85.02	10.76
Sodium (mmol/L)	50	264.89	108.71
Potassium (mmol/L)	50	60.00	37.13
Chloride (mmol/L)	50	246.93	105.79

Statistically significant at p<0.05

Table 2 represents the comparison of the anthropometric variables, blood pressure, urine electrolytes and fasting blood sugar in the male and female subjects. The result shows that the male subjects have a significantly lower waist circumference relative to the female subjects (p<0.05). The result also shows that the male subjects have a significantly lower weight, height and body mass index when compared to the female subjects (p<0.05). The systolic blood pressure was significantly higher in the male subjects relative to the female subjects (p<0.05). The sodium and potassium concentrations were higher in the male subjects compared to the female (p>0.05).

Table 2. Comparison of the Anthropometric Variables, Blood Pressure, Urine Electrolytes And Fasting Blood Sugar in the Male And Female Subjects (Mean±Sd, N=50).

Parameters	Female (n=25)	Male (n=25)	t-test	p-value
WC (cm)	86.49±16.71	79.08±4.77	2.131	0.038
Weight (kg)	74.71±20.72	61.76±11.53	2.731	0.009
Height (m)	1.73±0.09	1.64±0.10	3.086	0.003
BMI (kg/m^2)	25.59±7.15	22.24±2.74	2.190	0.033
SBP (mmHg)	120.12±11.51	136.16±22.26	-3.201	0.002
DBP (mmHg)	81.48±10.65	78.64±10.64	0.943	0.350
FBS (mg/dl)	86.97±9.59	83.08±11.69	1.285	0.205
Sodium (mmol/L)	245.61±116.75	284.17±98.60	-1.262	0.213
Potassium (mmol/L)	51.22±34.32	68.78±38.43	-1.704	0.095
Chloride (mmol/L)	266.29±131.02	227.57±70.02	1.303	0.199

Statistically significant at p<0.05

Tables 3, 4 and 5 are the correlations of the urine electrolytes with the anthropometric parameters. The urine sodium ion concentration positively correlated (p>0.05) in the female subjects but negatively (p>0.05) in the male subjects. Also, the mean body mass index positively correlated (p>0.05) in the male subjects (Table 3). The urine potassium ion concentration positively (p>0.05) correlated with BMI, weight and waist circumference in the female subjects.

Table 3. Correlation of Urine Sodium with Body Mass Index, Systolic Blood Pressure, Diastolic Blood Pressure, Height, Weight and Waist Circumference in Female and Male Subjects

Variables	Female (n=25)		Male (n=25)	
	R	p-value	R	p-value
Sodium vs WC	-0.229	0.271	0.072	0.732
Sodium vs SBP	0.089	0.672	-0.142	0.499
Sodium vs DBP	0.044	0.834	-0.220	0.291
Sodium vs BMI	-0.267	0.198	0.130	0.535
Sodium vs weight	-0.128	0.541	0.201	0.336
Sodium vs height	-0.172	0.411	0.052	0.806

*Statistically significant at p<0.05

Table 4. shows a positive and significant correlation between urine potassium and systolic blood pressure (p=0.015) and diastolic blood pressure (p=0.040) in the male subjects.

Table 4. Correlation of Urine Potassium with Body Mass Index, Systolic Blood Pressure, Diastolic Blood Pressure, Height, Weight and Waist Circumference in Female and Male Subjects

Variables	Female (n=25)		Male (n=25)	
	R	p-value	R	p-value
Potassium vs WC	0.135	0.521	-0.061	0.771
Potassium vs SBP	-0.240	0.247	0.481	0.015
Potassium vs DBP	-0.124	0.554	0.413	0.040
Potassium vs BMI	0.119	0.571	-0.122	0.562
Potassium vs weight	0.215	0.303	0.079	0.708
Potassium vs height	-0.098	0.642	0.278	0.178

*Statistically significant at p<0.05

There was a positive correlation (p<0.05) between the urine chloride ion concentration and BMI in the female subjects. There was also a positive correlation (p>0.05) between the urine chloride and waist circumference in the female subjects. The result also indicates that in the male subjects the urine chloride ion concentration positively (p>0.05) correlated with all the anthropometric parameters (Table 5).

Table 5. Correlation of Urine Chloride with Waist Circumference, Systolic Blood Pressure, Diastolic Blood Pressure, Body Mass Index, Weight and Height in Female and Male Subjects

Variables	Female (n=25)		Male (n=25)	
	r	p-value	R	p-value
Chloride vs WC	0.337	0.099	0.086	0.682
Chloride vs SBP	-0.238	0.252	0.183	0.381
Chloride vs DBP	-0.088	0.674	0.195	0.350
Chloride vs BMI	0.433	0.031	0.110	0.602
Chloride vs weight	-0.116	0.581	0.372	0.067
Chloride vs height	0.093	0.657	0.312	0.129

*Statistically significant at p<0.05

Table 6 shows the results of the correlation of fasting blood sugar with the anthropometric variables, urine electrolytes and systolic and diastolic blood pressures. There was a positive (p>0.05) correlation between fasting blood sugar and waist circumference, systolic blood pressure, body mass index, height, sodium and chloride ion concentration in both the female and male subjects.

Table 6. Correlation of Fasting Blood Sugar with Body Mass Index, Systolic Blood Pressure, Diastolic Blood Pressure, Waist Circumference , Weight, Height, Urine Sodium, Chloride and Potassium in Female and Male Subjects

Variables	Female (n=25)		Male (n=25)	
	R	p-value	R	p-value
FBS vs WC	0.232	0.265	0.106	0.612
FBS vs SBP	0.161	0.442	0.046	0.828
FBS vs DBP	0.245	0.237	-0.269	0.194
FBS vs BMI	0.269	0.194	0.393	0.052
FBS vs weight	-0.105	0.617	0.048	0.820
FBS vs height	0.202	0.333	0.124	0.556
FBS vs sodium	0.154	0.462	0.000	1.000
FBS vs potassium	-0.119	0.572	-0.102	0.627
FBS vs chloride	0.343	0.093	0.023	0.914

*Statistically significant at p<0.05

Table 7 shows the number and percentages of subjects having values that fall within the normal ranges, above the normal range and below the normal range. Of the 50 subjects (25 males and 25 females) that participated in this study, 43 subjects (86%;- 46% males and 40% females) had a waist circumference value within the normal range while 7 subjects (14%) had waist circumference values above 94cm which is considered the upper limit of normal. The table shows that 13 subjects (26%) had BMI values above normal with 34 subjects (68%) having values within the reference range (18.5-25 kg/m^2) while only 3 (6%) subjects had BMI values below 18.5kg/m^2. The result also shows that 42 subjects (84%) has their systolic and diastolic blood pressure values within normal ranges with 8 subjects (16%) having blood pressure values above normal where the reference range for SBP and DBP is ≤ 140/90 mmHg. Forty-six (46) subjects (92%) had a fasting blood sugar concentration within the normal range (70-100 mg/dl) with only 2 subjects (4%) having values above 100mg/dl and also 2 subjects (4%) having values below 70mg/dl. For sodium, 30 subjects (60%) had sodium ion values within the normal range (51-286 mmol/L) with 19 subjects (38%) having values above normal and only 1 subject (2%) having a value below normal. For potassium, 2 subjects (4%) have values above the reference range which is 25-125 mmol/L, 41 subjects (82%) have values within the normal range with 7 subjects (14%) having values below 25 mmol/L. For chloride, 8 subjects (16%) has a chloride ion concentration below 140 mmol/L with 21 subjects (42%) having a chloride ion concentration above 250mmol/L which is considered the upper limit of the normal while 21 subjects (42%) have normal values.

Table 7. Percentage Statistics of the Various Parameters in the Males and the Females

Variable	Gender	Normal range (%)	Above normal (%)	Below normal (%)
WC (cm)	Male	23 (46%)	2 (4%)	0
	Female	20 (40%)	5 (10%)	0
BMI	Male	21 (42)	3 (6)	1 (2)
(Kg/m^2)	Female	13 (26)	10 (20)	2 (4)
SBP	Male	18 (36)	7 (14)	0
(mmHg)	Female	24 (48)	1 (2)	0
DBP	Male	23 (46)	3 (6)	0
(mmHg)	Female	19 (38)	5 (10)	0
FBS	Male	22 (44)	1 (2)	2 (4)
(mg/dl)	Female	24 (48)	1 (2)	0
SODIUM	Male	14 (28)	11 (22)	0
(mmol/L)	Female	16 (32)	8 (16)	1 (2)
POTASSIUM	Male	22 (44)	2 (4)	1 (2)
(mmol/L)	Female	19 (38)	0	6 (12)
CHLORIDE (mmol/L)	Male	10 (20)	12 (24)	3 (6)
	Female	11 (22)	9 (18)	5 (10)

DISCUSSION

High habitual salt intake has been implicated in the aetiopathogenesis of hypertension for decades (Ekpo, 1989) Hypertension is the number one risk factor for death (Amir, 2005) and the most prevalent non-communicable disease globally (Deaton, 2011). Studies have incriminated low potassium intake as being important in the causation of hypertension (Walker, 1979). In addition, high sodium intake has been associated with type 2 diabetes mellitus and increased insulin resistance through hemodynamic changes in the kidneys by sustaining renal tubular reabsorption of sodium (*Vedovato, 2004*) Also, previous studies have demonstrated that high sodium intake is correlated with increased body weight and body fat mass (Larsen, 2013; Libuda, 2012). Table 1 shows a descriptive statistics of the mean of all the parameters measured. The table shows the mean values of waist circumference as 82.79 which fall within the normal reference range of not more than 80cm for women and not more than 94cm for men. The mean values of BMI being 23.91 falls within the normal reference range which is 18.5-25 kg/m^2. Also, the mean values of systolic blood pressure (128.14) and diastolic blood pressure (80.06) represented on the table also falls within the normal range which is 90-140mmHg and 60-90mmHg respectively. For the urine electrolytes; sodium, potassium and chloride with mean values of 264.89, 60.00, and 246.93 respectively also falls within the normal ranges which are 51-286mmol/L, 25-125 mmol/L and 140-250 mmol/L respectively. Therefore, the mean and standard deviation for all the parameters are within the normal ranges. Table 2 shows a positive and significant relationship in waist circumference (p<0.05) of males and females with a mean ± SD of 79.08±4.77 and 86.49±16.71 respectively, in systolic blood pressure (136.16±22.26 and 120.12±11.51 respectively) and body mass index (22.24±2.74 and 25.59±7.15). This table shows that the mean values of waist circumference and body mass index is higher in females than in males, while systolic blood pressure is higher in males than in females. Gender differences in blood pressure are detectable during adolescence and persist through adulthood. In all ethnic groups, men tend to have higher mean systolic blood pressure and diastolic blood pressure than women, and through middle age, the prevalence of hypertension is higher among men than women (Stamler, 1976). A study found out that BMI had a good general correlation with body fat percentage and BMI is widely accepted as one of the best indicator of nutritional status in adults (James, 1988; Shetty, 1994 and Kapoor, 2010). The prevalence of obesity (which can be determined by BMI and waist circumference) was greater in females than in males in the present study (Table 2). This agrees with previous studies by Wang, (Wang, 1978) Poulter et al. (Poulter, 1990), who have reported similar gender differences in adiposity.

Table 3 shows no positive and significant relationship between urine sodium and anthropometric variables and blood pressure. This finding agrees with a study carried out by Cheung et al. [28] who reported that systolic blood pressure is not associated with urinary sodium. Contrary to these findings, the WHO-Cardiovascular Diseases and Alimentary Comparison (WHO-CARDIAC) study showed a significant association between urinary sodium and both systolic and diastolic blood pressure. Human studies have however shown that the relationship between blood pressure and urinary sodium excretion varies with age, gender, and blood pressure state (Centozena, 2000; Jankunas, 2002 and Harshfield, 1991). It is possible that increases in salt intake increases diastolic blood pressure which in turn increases urinary sodium excretion in a Guytonian fashion (Guyton, 1987). Table 4 shows a positive and significant relationship between urine potassium and systolic and diastolic blood pressure in males ($p=0.015$ and $p=0.040$ respectively). This finding agrees with the finding by Stamler et al. (Stamler, 1972) about higher prevalence of hypertension in males than in females. Potassium and blood pressure hypothesis is that high potassium intake may have beneficial effect on lowering blood pressure (James, 1988) and it may be through increasing sodium excretion and decreasing calcium excretion (Adrogue, 2007). The table also shows a negative correlation between urine potassium and the anthropometric variables which means that anthropometric variables has no positive effect on urine potassium concentration. Table 5 shows that body mass index and fasting blood glucose were positively correlated among the male subjects ($p=0.052$). This result agrees with the result of a previous study by Adamu et al. (Adamu, 2006). It also shows a negative relationship between fasting blood glucose and urine sodium which agrees with a previous study carried out by Hae et al. (Hae, 2015). The present study shows a negative relationship between fasting blood sugar and systolic and diastolic blood pressure.

The result of this present study disagrees with the findings by Conen et al. (Conen, 2007). Wilson et al. (Cheung, 2000), who suggested that high blood pressure is a risk factor for the later development of type 2 diabetes mellitus (DM). It is estimated that 40-80% of diabetic patients have a two-fold increased risk of hypertension compared with that of normoglycemic individuals (Ekwunife, 2010 and Lonati, 2008). Table 6 shows a positive relationship between urine chloride and body mass index (females) ($p<0.05=0.031$) which agrees with a previous study carried out by Taylor et al. (Taylor, 2010). This implies that obesity can affect the excretion of urine chloride. Table 7 shows the percentage distribution of the various parameters. For the waist circumference, 46% of the males had their values within the normal range, 4% were above normal and none is seen below normal. For the females, 40% had normal values, 10% was above normal and none was below normal. Waist circumference is commonly used to assess abdominal obesity (Janssen, 2004). A study by Janssen et al. (Janssen, 2002), states that individuals with increased waist circumference levels are more likely to have hypertension, type 2 diabetes and dyslipidemia than those with normal waist circumference status irrespective of their weight. From table 7, 60% (28% and 32% males and females respectively) of the subjects have normal urine sodium values, 38% have values above normal and 2% below normal. The clinical condition that occurs as a result of excess sodium is known as hypernatremia and this may be caused by dehydration. It has been earlier stated that high habitual salt intake is a major risk factor for epidemic cardiovascular diseases (Stamler, 1997). Other studies have shown that body mass index and salt intake account for up to 70% of the variance in hypertension prevalence in the tropics (Forrester, 1998). An International Study on Micronutrient and Blood Presuure (INTERMAP) showed that lower salt intake can result in lower blood pressure (Stamler, 2003). Also from table 4.7, 82% of the study group has normal values of urine potassium, 4% has values above normal while 14% has values below the normal range. The clinical condition associated with reduced potassium is known as Hypokalemia. Urinary potassium excretion reflects the intake of vegetables and fruits (Smith, 2000) and a study carried out at the University of Southern California School of Medicine says that potassium-rich foods like avocados, bananas and leafy greens could help lower blood pressure. Therefore, from the result, the 14% of the population that has low potassium may have increased risk of hypertension as stated by He and MacGregor (He, 2001) that increased potassium intake lowers blood pressure in both hypertensive and normotensive people.

The percentage of the subjects having normal values for body mass index is 68% while 26% have values above normal and 6% have values below normal. As earlier stated (Table 4.2), a study found out that body mass index had a good general correlation with body fat percentage and that it is widely accepted as one of the best indicator of nutritional status in adults (James, 1988 and Kapoor, 2010). A previous study by (Ekwunife, 2010) and Mungreiphy et al. (Mungreiphy, 2011) says that blood pressure tends to increase with increasing body mass index and abdominal obesity which means that BMI positively correlates with blood pressure. This association has been demonstrated in Caucasian (McMahon, 1987 and Cassano, 1990), African (Poulter1985 and Kaufman, 1997) and Asian (Folson, 1994 and Gupter, 1995) populations. Therefore from the result, 26% of the subjects having BMI values above normal are at an increased risk of hypertension than the normotensive subjects. The systolic and diastolic blood pressure of the subjects within the normal range are both 84% while 16% in both categories were above normal and none was below normal. A few studies have suggested that increased blood pressure is a risk factor for cardiovascular disease (Lawes, 2008), dementia, chronic kidney disease, heart failure (Pella, 2003), and the later development of type 2 diabetes mellitus (Sola, 2009). This increased blood pressure in 16% of the study population may have been caused by increased BMI (26% having values above the normal range) and this finding agrees with the previous finding by (Ekwunife, 2010) and Mungreiphy et al. (Mungreiphy, 2011) that blood pressure increases with increasing BMI. About 92% of the subjects had normal values of fasting blood sugar, 4% were above normal and 4% of the male population had values below normal. Fasting blood sugar levels are mainly used in screening for diabetes (Daly, 1998). Diabetes is a clinical condition characterized by high blood sugar levels over a prolonged period. Hypertension often co-exists with type 2 diabetes (Ekwunife, 2010 and Ezzati, 2002) and this increases the risk of cardiovascular diseases by approximately twofold over 5-10 years (Lewington, 2008). Therefore from the result, a majority of the study population has normal glucose levels. Also from the result, 42% of the subjects have chloride concentrations within the normal range, 42% have chloride concentrations above the normal range and 16% have values below the normal range. Chloride is the most abundant anion and is associated with sodium in the extracellular compartment. An excess of chloride in the body is known as hyperchloremia which can result from a variety of conditions including water depletion, excessive chloride exposure and metabolic acidosis. Low level of chloride is known as hypochloremia and is usually caused by hypoventilation and vomiting. Hypochloremia is usually associated with hyponatremia and elevated bicarbonate concentration (Levitin, 1958).

Conclusion

The result from the study shows that urinary potassium and sodium are not directly related to fasting blood glucose and body mass index while urine potassium is related to blood pressure in the sampled subjects. It also shows that body mass index could be a factor that affects fasting blood sugar in males.

Recommendation

It is recommended that salt intake in the younger population should be regulated as it predisposes to higher risk of hypertension. Attention should be paid to other health problems that may accelerate the negative effects of diabetes and hypertension, such as smoking, obesity and lack of exercise or sedentary lifestyle. On the other hand, it is also recommended that eating more foods rich in potassium can help balance out the sodium and the best way to increase this potassium is to consume more fruits and vegetables such as bananas, avocados and leafy greens.

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