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Effect of water intake on fasting blood sugar levels after thirty minutes consumption among apparently healthy students in college of health technology, Calabar

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Abstract

This study aim to determine the effect of water intake on fasting blood sugar levels after 30 minutes of consumption among apparently healthy students in College of Health Technology, Calabar, Cross River State. The fasting blood sugar and 30 minutes blood sugar levels after water consumption of one hundred (100) students attending College of Health Technology, Calabar were determined using glucose oxidase/peroxidase method. The mean fasting blood sugar of apparently healthy students was 5.44±0.41mmol/L while that of 30minutes blood sugar after water consumption was 5.34±0.31mmol/L. There was no significant difference (P >0.05) between fasting blood sugar and 30 minutes blood sugar levels of apparently healthy students in College of Health Technology, Calabar. The mean fasting blood sugar levels among apparently healthy male students was 5.36±0.37mmol/L while that of 30minutes blood sugar after water consumption was 5.23±0.31mmol/L. There was no significant difference (P >0.05) between fasting blood sugar and 30 minutes blood sugar levels of apparently healthy male students in College of Health Technology, Calabar**.** The mean fasting blood sugar levels among apparently healthy female students was 5.57±0.45mmol/L while that of 30minutes blood sugar after water consumption was 5.31±0.30mmol/L. There was no significant difference (P >0.05) between fasting blood sugar and 30 minutes blood sugar levels of apparently healthy female students in College of Health Technology, Calabar. This shows that water intake of about 60CL 30 minutes prior to phlebotomy has no significant effect on sugar level. Therefore, patients with severe health conditions who are unable to undergo fasting blood sugar test may be allowed to drink water before undergoing such test.

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Introduction

Blood sugar concentration or blood glucose level is the concentration of glucose present in the blood of humans or other animals. Glucose is a simple sugar and approximately 4 grams is present in the blood of a 70kg (154 lb) human at all times. The body tightly regulates blood glucose levels as a part of metabolic homeostasis. The skeletal muscle and liver cells stored glucose in the form of glycogen. In fasting individuals, blood glucose is maintained at a constant level at the expense of glycogen stores in the liver and skeletal muscle (Wasserman, 2009).

A blood glucose level of 4 grams, or about a teaspoon in humans, is critical for normal function in a number of tissues, and the human brain consumes approximately 60% of blood glucose in fasting, sedentary individuals. An increase in blood glucose leads to glucose toxicity, which contributes to cell dysfunction and the pathology grouped together as complications of diabetes. Glucose can be transported from the intestines or liver to other tissues in the body through the bloodstream. Cellular glucose uptake is primarily regulated by insulin, a hormone produced in the pancreas. (Wasserman, 2009).

The lowest level of glucose is found in the morning, before the first meal of the day, and rise after meals for an hour or two by a few millimoles. Blood sugar levels outside the normal range may be an indicator of a medical condition. (Walker and Rodgers, 2006) low levels are referred to as hypoglycemia; the high level is referred to as hyperglycemia; Diabetes mellitus is characterized by persistent hyperglycemia from any of several causes, and it is the most prominent disease related to the failure of blood sugar regulation. There are different methods of testing and measuring blood sugar levels. Alcohol intake causes an initial increase in blood sugar and later tends to cause levels to fall. Certain drugs has also been found to increase or decrease glucose levels (Walker and Rodgers, 2006).

The normal blood glucose value ranges may vary slightly between laboratories. Many factors affect a person's blood sugar level. The body's homeostatic mechanism of blood sugar regulation (known as glucose homeostasis), when operating normally, restores the blood sugar level to a narrow range of about 4.4 to 6.1mmol/L (79 to 110mg/dL) (as measured by a fasting blood glucose test). (Screening for Type 2 Diabetes, 2000).

Normal blood glucose level (tested while fasting) for non-diabetics is between 3.9 and 7.1mmol/L (70 and 130mg/dL). The global mean fasting plasma blood glucose level in humans is about 5.5mmol/L (100mg/dL); (Danaei, 2011). However, this level fluctuates throughout the day. Blood sugar levels for those without diabetes and who are not fasting should be below 6.9mmol/L (125mg/dL). According to the American Diabetes Association, the blood glucose target range for diabetics, should be 5.0-7.2mmol/l (90-130mg/dL) before meals and less than 10mmol/L (180mg/dL) two hours after meals (as measured by a blood glucose monitor). (Davidson and Moreland, 2011 and Schuster, 2008)

Despite widely variable intervals between meals or the occasional consumption of meals with a substantial carbohydrate load, human blood glucose levels tend to remain within the normal range. However, shortly after eating, the blood glucose level may rise, in non-diabetics, temporarily up to 7.8mmol/L (140mg/dL) or slightly more. For people with diabetes maintaining "tight diabetes control", the American Diabetes Association recommends a post-meal glucose level of less than 10mmol/L (180mg/dL) and a fasting plasma glucose of 3.9 to 7.2mmol/L (70-130mg/dL). (American Diabetes Association, 2006).

The actual amount of glucose in the blood and body fluids is very small. In a healthy adult male of 75kg (165lb) with a blood volume of 5L, a blood glucose level of 5.5mmol/L (100mg/dL) amounts to 5g, equivalent to about a teaspoonful of sugar (USDA, 2009).

The aim of this study is to investigate the effect of water intake on fasting blood sugar level after thirty minutes consumption among apparently healthy students in College of Health Technology, Calabar.

The objectives of the study are as follows;
1. To determine the effect of water intake on fasting blood sugar level after 30 minutes of consumption.
2. To determine the effect of water intake on fasting blood sugar level after 30 minutes of consumption in male students of College Of Health Technology, Calabar.
3. To determine the effect of water intake on fasting blood sugar level after 30 minutes of consumption in female students of College Of Health Technology, Calabar.

Materials and methods

Study Area

The College of Health Technology, Calabar, started as Institute of Public Health in the later part of 1970, using the Diamond Health Centre, Diamond Hill, Calabar as its temporary site. During this period, twenty one (21) School Health Attendants and five (5) Community Nursing Students were admitted for training. Early in 1971, the Institute moved to No. 2 Hawkins Road, Calabar, yet another temporary accommodation. Other cadres of Health personnel trained by the School were Rural Health Assistants and Leprosy Attendants. The College moved to its permanent site at Mary Slessor Avenue, Calabar in 1975.

In 1976, the names of the Institution was changed to School of Health Technology following its approval by the Federal Ministry of Health. In the same year, the first batch of Public Health Nurses, direct intake of Community Midwives, Rural Health Superintendents, Public Health Superintendents (now Junior Community Health Extension Workers (JCHEWs)), Medical Records Assistants and Assistant Medical Records Officers were trained.

In 1985, the National Certificate in Health Records and Vital Statistics Program was introduced.

Other programs subsequently introduced were: Direct COmmunity Health Officers, Community Health Supervisors, Health Information Management Technicians, Senior Community Health Extension Workers (SCHEWs), Medical Laboratory Assistants/Technicians, Pharmacy Technicians and Radiography Technicians.

In 1999, the College was granted provisional approval by National Board for Technical Education (NBTE) to run Public Health Nursing (PHN) and Environmental Health (EH) Programs at HND level.

On November 6, 2201, the Cross River State College of Health Technology, Calabar Law was assented to by His Excellency Mr. Donald Duke, the then Governor of Cross River State.

In 2011, NBTE granted full accreditation for HND Public Health Nursing and Provisional accreditation to run the National Diploma in Health Information Management, Environmental Health and Community Health Programs.

In 2013, a Centre for Entrepreneurial Studies (CES) was established as a mandatory accreditation requirement by NBTE. In the same year, NBTE then granted the College full accreditation to run HND in Environmental Health and Health Information Management Programs. In 2014, the College introduced Dispensing Opticianry Program and re-introduced the Radiography Technicians Program.

The staff strength of the College has also grown for both Academic and Non-Academic staff complementary to the College expansions. (http://www.chtcalabar.edu.ng/Pages/History.html)

Research questions

1. Does drinking water before 30 minutes of a fasting blood sugar test has effect on fasting blood sugar levels among apparently healthy students in College of Health Technology, Calabar?

2. Does drinking water before 30 minutes of a fasting blood sugar test has effect on fasting blood sugar levels among apparently healthy male students in College of Health Technology, Calabar?
3. Does drinking water before 30 minutes of a fasting blood sugar test has effect on fasting blood sugar levels among apparently healthy female students in College of Health Technology, Calabar?

Research Hypothesis

The following hypotheses were formulated for this study:

1. There is no significant difference between fasting blood sugar and 30 minutes blood sugar levels after water consumption among apparently healthy students in College Of Health Technology, Calabar.
2. There is no significant difference between fasting blood sugar and 30 minutes blood sugar levels after water consumption among apparently healthy male students in College Of Health Technology, Calabar.
3. There is no significant difference between fasting blood sugar and 30 minutes blood sugar levels after water consumption among apparently healthy female students in College Of Health Technology, Caliber.

Significance of the Study

The research will serve as base line survey information in the health sector for determining the effect of water intake on fasting blood sugar levels after 30 minutes of water consumption among individuals intending to go for fasting blood sugar test. Sugar level gives vital clues about how a person's body is managing blood sugar. It also serves as a guild to patients intending to drink water before coming to the laboratory for fasting blood sugar test.

Operational definition of terms

Effects: a change that result when something is done or happen

Water: the clear liquid that has no color, taste or smell that falls from clouds as rain, that forms streams, lake and seas and it is used for drinking, washing etc.

Intake: the amount of something (such as food or drink) that is taken into your body

Fasting blood sugar: it refers to the blood sugar sample collected after a period of no food intake. This period is usually between 10-14 hours.

Consumption: Consumption is the act of eating or drinking something

Students: persons who attend a school college or university.

Population of the study

The population of the study was apparently healthy students aged 18-25 years in College of Health Technology, Calabar Municipality Local Government Area of Cross River State.

Sampling size and sampling Techniques

Simple random sampling technique was used to select One Hundred (100) apparently healthy students, consisting of fifty (50) male and fifty (50) female students to enable every participants have equal opportunity of being chosen.

Sample collection and analysis

Two fluoride oxalate bottles were used for each student. After overnight fasting of about 10-12 hours, 2mls of venous blood was aseptically collected by venipuncture from all the students between 8-10am into already labeled fluoride oxalate bottles.

A sachet water containing 60cl water was given to the students to drink. After thirty (30) minutes, another 2mls of venous blood was aseptically collected from all the students into the second labeled fluoride oxalate bottles. They were mixed and centrifuged at 3,000rpm for 5 minutes to obtained plasma. Glucose oxidase/peroxidase method was used to determine the blood glucose concentration of the plasma samples.

Ethical Consideration

Verbal consent was obtained from the subjects after the aim of the research had been explained and confidentiality of the participants result ensured throughout the research.

Determination of blood glucose using glucose oxidase /peroxidase method

Glucose oxidase/peroxidase reagent kit was obtained from Randox Laboratories, United kingdom. The reagent was stored at 4°c

Principle

Glucose oxidase catalyses the oxidation of glucose to produce hydrogen peroxide and gluconic acid. The hydrogen peroxide produced in the presence of an enzymes called peroxidase is broken down and the oxygen given off oxidizes 4-Aminophenazone and phenol to produce a pink colour complex.

Procedure

1.Three glass test tubes were set up labelled as blank, standard and sample

2.1000NL of glucose oxidase preoxidase reagent was pipetted into the three glass test tubes

3.10NL of distilled water was added to the blank test tube

4.10NL of standard reagent was added to the standard test tube

5.10NL of plasma was added to the sample test tube

6.They were mixed and incubated at 37°c for 5 minutes in water bath

7.The absorbance of colour solution formed was measured within 30 minutes using spectrophotometer at 520nm

8.The concentration of glucose was calculated in the sample using the formula.

Concentration of glucose

$$= \frac{Absorbance\ of\ test}{Absorbance\ of\ standard} x\ concentration\ of\ standard$$

Data analysis

This was carried out using the mean, standard deviation and student's t–test. The results was considered statistically significant at P<0.05

Results

The results of fasting blood sugar and 30mimutes blood sugar levels after water consumption which was determined in one hundred (100) student's attending College of Health Technology, Calabar are shown below;

Hypothesis One

There is no significant difference in fasting blood sugar and 30 minute blood sugar level after water consumption among apparently healthy students in College of Health Technology, Calabar. The analysis is shown in table 1.

Table 1. Comparison of mean fasting blood sugar and 30 minutes blood sugar levels after water consumption among apparently healthy students in College of Health Technology, Calabar.

Subject	N	Blood sugar level (mmol/L)
Fasting blood sugar	100	5.44 ± 0.41
30 minutes blood sugar after water consumption	100	5.43 ± 0.31
Calculated t-test		1.909
Critical t-test		1.984
P – Value		0.97
Probability level		P > 0.05
Degree of freedom		99
Comment		NS

Keys: Means ± SD

S - Significant
NS - No significant
N - Number
df - Degree of freedom

Table 1 shows the fasting blood sugar and 30 minutes blood sugar levels among apparently healthy students in College of Health Technology, Calabar. The mean fasting blood sugar level was 5.44 ± 0.41mmol/L while that of 30 minutes blood sugar level after water consumption was 5.43 ± 0.31mmol/L respectively. There was no significant difference (P > 0.05) between fasting blood sugar and 30 minutes blood sugar levels after water consumption among apparently healthy students in College of Health Technology, Calabar.

Hypothesis 2

There is no significant difference in fasting blood sugar and 30 minute blood sugar levels after water consumption among apparently healthy male students in College of Health Technology, Calabar. The analysis is shown in table 2.

Table 2. Comparison of mean fasting blood sugar and 30 minutes blood sugar levels after water consumption among apparently healthy male students in College of Health Technology, Calabar.

Subject	N	Blood sugar level (mmol/L)
Fasting blood sugar	50	5.36 ± 0.37
30 minutes blood sugar after water consumption	50	5.23 ± 0.31
Calculated t-test		0.081
Critical t-test		2.009
P – Value		0.53
Probability level		P > 0.05
Degree of freedom		49
Comment		NS

Keys: Means ± SD

S - Significant

NS - No significant

N - Number

df - Degree of freedom

From table 2, the mean fasting blood sugar level was 5.36 ± 0.37mmol/L while that of 30 minutes blood sugar level after water consumption was 5.23 ± 0.31mmol/L respectively. There was no significant difference (P > 0.05) between fasting blood sugar and 30 minutes blood sugar levels after water consumption among apparently healthy male students in College of Health Technology, Calabar.

Hypothesis three

There is no significant difference in fasting blood sugar and 30 minute blood sugar levels after water consumption among apparently healthy female students in College of Health Technology, Calabar. The analysis is shown in table 3.

From table 3, the mean fasting blood sugar level was 5.57 ± 0.45mmol/L while that of 30 minutes blood sugar level after water consumption was 5.31 ± 0.30mmol/L respectively. There was no significant difference (P > 0.05) between fasting blood sugar and 30 minutes blood sugar levels after water consumption among apparently healthy male students in College of Health Technology, Calabar.

Table 3. Comparison of mean fasting blood sugar and 30 minutes blood sugar levels after water consumption among apparently healthy female students in College of Health Technology, Calabar.

Subject	N	Blood sugar level (mmol/L)
Fasting blood sugar	50	5.57 ± 0.45
30 minutes blood sugar after water consumption	50	5.31 ± 0.30
Calculated t-test		1.268
Critical t-test		2.001
P – Value		0.89
Probability level		P > 0.05
Degree of freedom		49
Comment		NS

Keys: Means ± SD

S - Significant

NS - No significant

N - Number

df - Degree of freedom

Discussion

Findings from our hypotheses have shown that there was no significant difference (P > 0.5) in the fasting blood sugar and 30minutes blood sugar levels after water consumption among apparently healthy students in College of Health Technology, Calabar. This implies that a sachet water containing 60cl of water taken 30 minutes prior to phlebotomy produced no significant changes on fasting blood sugar levels.

Water contains no carbohydrate or calories, it is the perfect drink for people with diabetes. Studies have shown that drinking water could help control blood glucose level. Water will not raise blood glucose levels, which is why it is so beneficial to drink when people with diabetes have high blood sugar, as it enables more glucose to be flushed out of the blood (www.diabetes.co.uk, 2022)

Given the significance of a reliable laboratory results in medical diagnosis, instructions on carrying out fasting blood sugar test must be clearly explained to patients to ensure quality sample collection. Based on the general recommendations published in 2014 on the harmonization of water intake, water intake during fasting hours is permitted before phlebotomy (Simundic *et al.,* 2014).

However, it is not properly known on the exact volume of water that should be allowed during fasting state.

Absorption of water is a very rapid process. A recent study has shown that water appears in the blood as soon as 5minutes after consumption (Peronnet *et al.,* 2012). A study by Torsdottir and Anderson, 1989 showed that a 300ml water intake along with food after 12 hours fasting period increases blood glucose and insulin concentrations in apparently healthy subject, and only glucose in well controlled diabetic patients. Our study had showed that no significant difference was observed in fasting blood glucose concentration. The finding is in agreement with the earlier works by Silvia *et al.,* 2017 which showed that no significant changes were observed in glucose concentration in the fasting state after I hour intake of 300ml water. This suggested that only food and water intake may significantly increased blood glucose concentration.

The only limitation observed in this work was the low number of subjects that participated in the study. Therefore, further research on a larger population should be carried out to confirm the results derived from this work. Also, considering the fact that subjects drank only a sachet water containing 60cl of water after the overnight fasting period, it will be useful to determine the influence of different volumes of water consumed during fasting state on fasting blood sugar test to accurately determine the maximum water intake required during fasting state.

Conclusion and recommendation

The study had shown that there was no significant difference in fasting blood sugar level of apparently healthy students after 30 minutes consumption of sachet water containing 60cl of water prior to phlebotomy. It is therefore an important contribution to future research aiming at determining the maximum volume that could be permitted prior to fasting blood sugar test and other clinical biochemical determination during fasting state.

Therefore, patients with severe health condition who are unable to undergo fasting blood sugar test may be allow to drink water before undergoing such test.

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