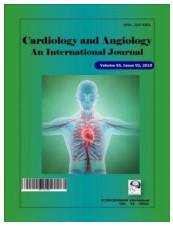

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Cardiovascular Health and Disease Risk Status in Type II Diabetics

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Authors' contributions

This work was carried out in collaboration between all authors. Author ICE designed the study. Author RNA wrote the protocol. Authors MAO and UAE managed the analyses and literature searches of the study, while author OBU supervised the experimental protocol. All authors read and approved the final manuscript.

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ABSTRACT

Often linked with several complications and comorbidities, studies have shown Diabetes mellitus (DM) as a common, chronic disease across the globe. This study was designed to explore the CVD risk factors among Type 2 DM patients in a tertiary hospital in South-East, Nigeria. Seventy two (72) participants [36 hyperglycaemics (Type II DM) and 36 normoglycaemics (control)] were drawn from the University of Nigeria Teaching Hospital, Enugu State. Socio-demographic data, anthropometric parameters, percentage body fat and ankle-brachial indices were obtained. Other Variables such as age, height, weight, heart rate, body mass index (BMI) and waist-hip ratios (WHR) were recorded as well. The study found, using the one-way Analysis of variance (ANOVA), a significant difference ($p < .05$) in percentage body fat and heart rate between groups (hyperglycaemics and normoglycaemics). A gender-dependent significant difference was also observed in ankle-brachial

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index between normoglycaemics, with an accompanying insignificant difference for ankle-brachial index, BMI and WHR in both groups. Life style patterns with increased physical activity levels that will combat cardiovascular risks is highly recommended. The continuous monitoring of cardiovascular (Blood pressure, pulse rates) health indicators is also encouraged.

Keywords: Cardiovascular disease risk; diabetes mellitus; anthropometric measures.

1. INTRODUCTION

With symptoms such as excessive eating (polyphagia), excessive thirst (polydipsia) and excessive urination (polyuria); Diabetes mellitus (DM) is a "hydra-headed" metabolic disorder of carbohydrates, fats and protein breakdown. It is a disease in which the pancreas produces insufficient amounts of insulin (Type I), or in which the body's cells fail to respond appropriately to available insulin (Type II) with Insulin being a hormone that helps the body's cells absorb glucose (sugar) so it can be used as a source of energy. In people with Diabetes, glucose levels build up in the blood and urine, causing excessive urination, thirst, hunger, and problems with fat and protein metabolism [1-3].

It is an established fact that, as part of the complications of DM, blockages of large blood vessels in diabetics will elicit several cardiovascular problems, including high blood pressure, heart attack, and stroke. Although these conditions also occur in non-diabetics, people with Diabetes are two to four times more likely to develop cardiovascular disorders. Other than complications seen through cardiovascular disorders, DM has also been shown to be a leading cause of new cases of blindness in people aged 20 to 74. In the kidneys, DM can lead to *nephropathy* (the inability of the kidney to properly filter toxins from the blood); with about 40 percent of new cases of such reportedly caused by DM [4-5].

The American Heart Association in 2017 reported that 68% diabetics of 65 years old and above die from one form of heart disease or the other; with 16% of such being stroke. Diabetic adults are therefore at two to four times risk of dying from cardiovascular related ailments and complications [6]. Again, type II diabetics have been reported to be at higher risk of developing peripheral arterial diseases that can cause fat deposition and thickening/clogging of arteries in the lower extremities.

A 2014 study found no association between cardiovascular disease risk factors and socioeconomic status of diabetics [7]. Studies have also shown that overweight, obesity and sedentary life styles are prevalent in patients at high risk of type II DM, with ankle-brachial index posing an insignificant difference to type II DM sufferer. Parameters of heart rate variabilities that depict parasympathetic modulations of the heart have also been seen in hyperglycaemics compared to normoglycaemics [8]. Available findings also report that over 1.70 million of global cases of DM are seen in Nigerians above 15 years of age; with about 70,000 of them occurring as type I in children under the ages of 15 years [9]. As DM currently rises daily as a result of obesity, population growth, and sedentary lifestyles; it has been predicted to be over 360 million cases by 2030 [10]. Though efforts have been made to prevent its life threatening complications through the use of oral hypoglycemic (blood sugar reducing) agents like sulphonylureas, cardiovascular health indicators may be of immense importance in checking and predicting DM prior to onset; hence, the need for this study.

1.1 Aim of Study

The purpose of this study was to assess the cardiovascular status and disease risk amongst patients with type II Diabetes mellitus. Study compared the differences in cardiovascular and anthropometric health markers like percentage body mass, ankle brachial index (ABI), body mass index (BMI), Waist-Hip ratio (WHR) and heart rates between diabetics (type II DM) and non-diabetic subjects. The study also determined for diabetics and normoglycaemics, the relationship between disease risk and duration of DM with respect to age, gender, BMI, and WHR.

2. MATERIALS AND METHODS

2.1Study Design

Study was a cross sectional kind of research design.

2.2 Study Area

Study was conducted at the University of Nigeria Teaching Hospital, Ituku – Ozalla, Enugu State, Nigeria.

2.3 Study Population

The study population involved type II diabetic subjects from 18 years and above who regularly visited the University of Nigeria Teaching Hospital (UNTH), Enugu State; for medical check-ups. Non-diabetic adults were also sampled from within the hospital and environs and recruited as control.

2.4 Sample and Sampling Technique

Purposive sampling technique was used to select participants based on their proximity and accessibility to the hospital where the study was conducted. The choice of hospital (UNTH) was based on the presence of treatment unit for management of Diabetes and cardiovascular diseases. Sample size calculation was based on the equation:

$$n = \frac{Z2 \times p\,(1 - p)}{d2}$$

Where:

n = Sample Size
p = estimated population based on incidence. However, a WHO 2013 report has it that prevalence ratio of DM in Nigeria is 5.0%. Thus, proportion = .05
z = 1.96 at 95% confidence interval
d = margin of error = .05; allowing for a 5% error
(Cochran, 1977)

2.5 Subjects' Selection for Participation

Irrespective of gender and tribe, diabetic subjects from 18 years and above who have been diagnosed of type II DM for a minimum of one week, and were booked for regular check-ups at UNTH were included for participation in the study. Diabetics with other complications of DM (like stroke) other than aforementioned were excluded from the study. Pregnant subjects and those with foot ulcer (being a chronic symptom of DM) were also exempted from the study.

2.6 Instruments for Data Collection

Socio-demographic and medical information as age, gender, ethnicity, tobacco smoking record, and duration of being diabetic were obtained with a proforma. A stadiometer was used to obtain subjects' heights, with weights taken with a weighing scale. Tape rule and electronic sphygmomanometer were respectively used to obtain hip circumferences and blood pressures.

2.7 Data Collection Procedure

First, purpose of study was orally explained to participants with their informed consent sought and obtained. A proforma was later used to obtain sociodemographic data and medical records as age, sex, ethnicity, smoke habit/status and duration for which participant has been diagnosed of DM; after which heights and anthropometric variables were measured with a stadiometer, weighing scale, and tape rule respectively. Percentage body fat was also measured with a body fat analyzer, while ankle-brachial index with a sphygmomanometer.

2.8 Ethical Considerations

Ethical approval was sought and obtained from the University of Nigeria Teaching Hospital. Informed consent was also obtained from participants prior to investigation. Participants were assured of the confidentiality of their personal data before obtaining their records

2.9 Statistical Analysis

Continuous variables (age, height, weight, BMI and WHR) were reported with statistical tables as mean differences between cardiovascular disease and control group. Statistical level of significance was set at $p < 0.05$. Differences in mean between obtained variables were obtained with the analysis of variance (ANOVA).

3. RESULTS

Refer to Tables 1 and 2 (below) for summary of results after analysis.

Table 1. Non-Diabetics Disease Risk based on BMI

Risk status	BMI	Classification	Occurrence	Percentage
Increased	< 18.5	Underweight	0	0%
Low	18.6-21.99	Acceptable	6	16.7%
Very Low	22.0-24.99	Acceptable	15	41.7%
Increased	25.0-29.99	Overweight	13	36.1%
High	30.0-34.99	Obesity I	1	2.8%
Very High	35.0-39.99	Obesity II	1	2.8%
Extremely High	≥ 40.00	Obesity III	0	0%
Total			36	100%

Table 2. Disease Risk based on BMI for Diabetics

Risk status	BMI	Classification	Occurrence	Percentage
Increased	< 18.5	Underweight	None	0%
Low	18.6-21.99	Acceptable	3	8.3%
Very Low	22.0-24.99	Acceptable	11	30.6%
Increased	25.0-29.99	Overweight	19	52.8%
High	30.0-34.99	Obesity I	2	5.6%
Very High	35.0-39.99	Obesity II	1	2.8%
Extremely High	≥ 40.00	Obesity III	None	0%
Total			36	100%

Table 3. Disease Risk based on Mean values of Waist-Hip Ratio (WHR) for Diabetics and Non-Diabetics

Variables	Diabetics	Non Diabetics	t-value	p-value
WHR	.94 ± .15	.97 ± .10	1.17	.244
HR	80.05 ± .15	71 .61 ± 7.59	-4.47	.001
%BF	38.77 ± 3.91	33 .86 ± 4.95	-4.67	.001
ABI	.95 ± .09	.98 ± .04	1.57	.120

p-value was taken as significant at < .05. Here, WHR= Waist-Hip Ratio, HR= Heart Rate, %BF= percentage body fluid and ABI= Ankle Brachial Index

4. DISCUSSION

As a syndrome of abnormal carbohydrate, fat and protein metabolism, Diabetes is a major public health problem that represents a growing medical disorder, with concomitant morbidity and mortality affecting people of all ages [6].

Current study assessed cardiovascular health and disease risk status in type II diabetics. From our findings, no significant difference was seen for ankle-brachial index of diabetic and non-diabetic individuals (Table 3). Morrison et al. [11] had reported a similar finding in their work on "Overweight, fat patterning, and cardiovascular disease risk factors in black and white girls". They found a significant indifference between diabetics and non-diabetics for cardiovascular mortality. Their finding may be due to ankle pressure elevation in calcification of the medial artery which has been shown to be common in diabetics.

For percentage body fat (PBF), current study found a significant difference in PBF of diabetics and non-diabetics (Table 3). This outcome corresponds with those of Jayesh et al. [12]; who showed that type II diabetics have unfavourable body fat distribution than non-diabetics, with an accompanying increase in visceral fat and decrease in protective fat. Excess of such visceral fat can be traced to hepatic insulin resistance and total body fat distribution. In type II diabetics, the excess fat was apparently nullified after matching with their BMI. For BMI, current study showed an insignificant difference in BMI of diabetics against Non-diabetics (Tables 1 and 2). A similar result was seen in a case study that determined if BMI trajectory affects the risk of type II Diabetics. From the study, the trajectories of BMI in diabetics were similar to those of Non-diabetics in Japan [13]. From table I, it is seen that 16.7% of non-diabetic participants had a BMI of between 18.6 and 21.99. They are regarded as low-disease

individuals and are at a minimal or no risk of cardiovascular diseases.

Current study also observed an insignificant difference in WHR of diabetic individuals upon comparison with Non-diabetics. This difference may largely be traceable to the fact that most participants from both groups fell within the overweight category, tending towards Obesity. This finding however contradicts that of Pankaj and Amita [8] who stated that WHR of diabetics were higher than those of Non-diabetics since Hip circumference has been a general marker for obesity, excess fat is concentrated in the hip of women and in the waist of men.

Findings obtained from heart rates measurements show a statistically significant difference in heart rates of diabetics against non-diabetic subjects. This corresponds with previous findings of Morrison et al. [11], who found that parameters of heart rate variability are reduced and depict parasympathetic modulation of the heart in diabetics as against non-diabetics. This finding may be attributed to vagal sympathetic degeneration resulting from damage to the vagus nerve [14-15].

4.1 Importance of Study

Results of this study could provide useful information to clinical practice and academics. This study will also enlighten health care providers and practitioners on the need to screen for cardiovascular and disease risk statuses of type II diabetics so as to guide appropriate intervention and management.

5. CONCLUSION

Considering the results of this study, it can be said that no significant difference exists between the ankle-brachial index and BMI of diabetic (Type II DM) and non-diabetic individuals; though there may exist other risks of cardiovascular complications for diabetics. This existential high risk was deduced from increased heart rate, percentage body fat and obesity as observed via BMI outcome for this study. Irrespective of gender, subjects were also seen to have a statistically significant difference in their percentage body fat, heart rate and BM

6. RECOMMENDATIONS

Continuous and regular study with higher samples at different locations is recommended. To curtail the risk of cardiovascular diseases, continuous and regular training programs and exercise for obese individuals is recommended. To help monitor their quality of life, pressure monitors should be assessable to diabetic individual also, proper dietary habits and avoidance of sedentary lifestyle is highly recommended.

ETHICAL APPROVAL AND CONSENT

Ethical approval was sought and obtained from the University of Nigeria Teaching Hospital. Informed written consent was also obtained from participants prior to investigation. Participants were assured of the confidentiality of their personal data before obtaining their records.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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