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The Correlation between Glycemic Parameters (FPG, Hba1c, and Insulin) and Anthropometric Parameters (BMI, WC, WHR, WHTR, BRI, and VAI) among Patients with Type 2 Diabetes Mellitus

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Abstract: The study examined the correlate between glycemic parameters (FPG, HBA1C, and INSULIN) and anthropometric parameters (BMI, WC, WHR, WHTR, BRI, AND VAI) among patients with type 2 diabetes mellitus. In carrying out this study comparative cross-sectional study was adopted. The study population consisted of one hundred (100) diagnosed type 2 diabetic patients and one hundred (100) apparently healthy, age- and sex-matched non-diabetic individuals who served as controls. All participants were aged between 30 and 70 years. Ten (10) mL of venous blood samples were collected from each participant after overnight fast using standard aseptic procedures and distributed into appropriate tubes for the determination of fasting plasma glucose (FPG), glycated hemoglobin (HbA1c), insulin, lipid profile, and oxidative stress markers. Serum and plasma were prepared by centrifugation at 3000 rpm for 10 minutes, while whole blood was used for selected analyses. The samples were analyzed using standard laboratory methods. Data obtained were analyzed using Statistical Package for Social Sciences (SPSS) version 25.0. The results revealed that fasting plasma glucose (FPG) had significant negative correlations with body mass index (BMI) ($r = -0.216$, $p = 0.031$) and waist-to-hip ratio (WHR) ($r = -0.205$, $p = 0.041$), while a significant positive correlation was observed between FPG and body roundness index (BRI) ($r = 0.211$, $p = 0.035$) among patients with type 2 diabetes mellitus. The study concluded that the observed relationships between glycaemic and anthropometric parameters indicate an association between glycaemic status and measures of body size and fat distribution among patients with type 2 diabetes mellitus. One of the recommendations made was that patients with type 2 diabetes mellitus should undergo regular assessment of FPG, HbA1c, and appropriate anthropometric parameters to facilitate effective monitoring of glycemic and metabolic status.

Keywords: Glycemic Parameters, Anthropometric Parameters Patients, Type 2 Diabetes Mellitus

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Introduction

Anthropometric parameters provide simple and practical measures for assessing body size, fat distribution, and cardiometabolic risk among individuals with T2DM. Body mass index (BMI) reflects general body weight relative to height, whereas waist circumference (WC), waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR) provide information about central or abdominal adiposity. More recently, indices such as the body roundness index (BRI) and visceral adiposity index (VAI) have been used to provide additional information about body shape and visceral adipose dysfunction. Excess body fat, particularly central adiposity, is closely associated with insulin resistance and abnormal glucose metabolism. Therefore, examining the correlation between glycaemic parameters (FPG, HbA1c, and insulin) and anthropometric parameters (BMI, WC, WHR, WHtR, BRI, and VAI) may help to clarify the relationship between body composition, fat distribution, insulin metabolism, and glycaemic control among patients with T2DM.

Glycemic control is an important aspect of the management of type 2 diabetes mellitus because persistent elevation of blood glucose increases the risk of both acute and long-term complications. Fasting plasma glucose (FPG) is commonly used to assess the level of blood glucose after an overnight fast and provides information about the patient's current or short-term glycemic status. In contrast, glycated haemoglobin (HbA1c) reflects the average blood glucose concentration over approximately the previous two to three months and is therefore useful for assessing longer-term glycemic control. The American Diabetes Association recognizes both FPG and HbA1c as important measures for the diagnosis and monitoring of diabetes, while differences between the two measurements may occur because they assess different periods of glycemic exposure. Among type 2 diabetic patients in Owerri, examining the patterns of FPG and HbA1c levels can therefore provide useful information about the extent to which patients achieve recommended glycemic targets.

The pattern of glycemic control among type 2 diabetic patients may range from good or controlled glycemia to moderate and poor control, depending on factors such as adherence to medication, dietary practices, physical activity, duration of diabetes, obesity and access to appropriate healthcare. FPG provides an indication of fasting glucose regulation, whereas HbA1c provides a broader picture of sustained glucose control. The biochemical assessment of diabetic patients commonly includes FPG and HbA1c because abnormalities in these parameters are strongly associated with poor metabolic control and increased risk of diabetic complications[1]. In the context of Owerri, where urbanization, dietary changes and reduced physical activity have contributed to the increasing burden of non-communicable diseases, variations in FPG and HbA1c levels may be expected among patients with type 2 diabetes. Patients with persistently elevated FPG are likely to have inadequate fasting glycemic control, while elevated HbA1c

indicates prolonged exposure to hyperglycemia and may identify patients whose overall glycemic management remains unsatisfactory.

The combined assessment of FPG and HbA1c is particularly valuable in understanding the overall pattern of glycemic control among type 2 diabetic patients in Owerri. A patient may have an acceptable FPG measurement on a particular day while still having an elevated HbA1c because of previous periods of poor glycemic control. Similarly, differences between FPG and HbA1c measurements may provide useful evidence about variations in glucose levels over time. Persistent hyperglycemia is also closely related to oxidative stress, inflammation and metabolic disturbances that contribute to the progression of diabetes and its complications[2]. Therefore, determining the patterns of FPG and HbA1c levels among patients attending healthcare facilities in Owerri can help reveal the proportion of patients with adequate or inadequate glycemic control and provide evidence for improving diabetes monitoring and management. Such assessment is particularly relevant because local biochemical patterns may be influenced by the dietary, environmental and lifestyle characteristics of the population. “Beyond their role in assessing glycaemic control, FPG and HbA1c may be influenced by factors such as excess body weight, abdominal adiposity and insulin resistance. Therefore, examining their relationship with anthropometric parameters may provide further insight into the metabolic characteristics of patients with type 2 diabetes mellitus.

Insulin plays a central role in the regulation of blood glucose and the maintenance of normal metabolic function. In type 2 diabetes mellitus, insulin resistance and progressive impairment of pancreatic β-cell function contribute to disturbances in glucose metabolism. Excess adiposity, particularly abdominal and visceral fat accumulation, is strongly associated with insulin resistance because adipose tissue can promote the release of free fatty acids and inflammatory mediators that interfere with normal insulin action. Consequently, anthropometric indicators such as BMI, WC, WHR, WHtR, BRI, and VAI may provide useful information about the relationship between adiposity and insulin metabolism. Examining the correlation between insulin levels and these anthropometric parameters may therefore contribute to a better understanding of the metabolic relationship between body fat distribution and glycaemic regulation in patients with type 2 diabetes mellitus.

Anthropometric measurements, including body mass index (BMI), waist circumference (WC), waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR), serve as important indicators of obesity and central adiposity, which are major risk factors for type 2 diabetes mellitus[3]. The relationship between anthropometric indices and diabetes risk has been well-established, with central obesity being particularly strongly associated with insulin resistance and diabetes development. Unlike subcutaneous fat, visceral adipose tissue is metabolically active and releases free fatty acids and inflammatory cytokines that contribute to insulin resistance and metabolic dysfunction.

Research problem

Type 2 diabetes mellitus is closely associated with abnormalities in glucose regulation, insulin metabolism, excess body weight, and abnormal fat distribution. Although fasting plasma glucose (FPG) and glycated haemoglobin (HbA1c) are commonly used to assess glycaemic status, insulin provides additional information about insulin secretion and metabolic dysfunction, while anthropometric measures such as body mass index (BMI), waist circumference (WC), waist-to-hip ratio (WHR), waist-to-height ratio (WHtR), body roundness index (BRI), and visceral adiposity index (VAI) provide different measures of general and central adiposity. However, the strength and direction of the relationships between these glycaemic and anthropometric parameters may vary among patients with type 2 diabetes mellitus. In particular, there is limited information on the relationship between FPG, HbA1c and insulin levels and the selected anthropometric indices among patients with type 2 diabetes mellitus in Owerri,

Imo State. This creates a need to determine whether variations in body size, waist distribution and visceral adiposity are associated with differences in glycaemic and insulin status. Therefore, the problem of this study is to establish the correlation between glycaemic parameters (FPG, HbA1c, and insulin) and anthropometric parameters (BMI, WC, WHR, WHtR, BRI, and VAI) among patients with type 2 diabetes mellitus.

Research objective

The study sought:

1. To determine the correlation between glycemic parameters (FPG, HBA1C, AND INSULIN) and anthropometric parameters (BMI, WC, WHR, WHTR, BRI, AND VAI) among patients with type 2 diabetes mellitus

Research questions

1. What is the correlation between glycemic parameters (FPG, HbA1c, and insulin) and anthropometric parameters (BMI, WC, WHR, WHtR, BRI, and VAI) among patients with type 2 diabetes mellitus?

Biochemical Markers in Type 2 Diabetes

Glycemic Markers

Fasting plasma glucose (FPG) and glycated hemoglobin (HbA1c) are the primary markers used for the diagnosis and monitoring of diabetes[5]. FPG measures glucose concentration after an overnight fast and reflects hepatic glucose production, while HbA1c provides an estimate of average glycemic control over the preceding 2-3 months. The American Diabetes Association recommends HbA1c ≥ 6.5% or FPG ≥ 7.0 mmol/L (126 mg/dL) as diagnostic criteria for diabetes.

HbA1c has several advantages over FPG, including greater convenience (no fasting required), less day-to-day variability, and stronger association with diabetes complications. HbA1c reflects the average glucose exposure over time and is less affected by acute factors such as stress or illness. However, HbA1c may be affected by conditions that alter red blood cell turnover, such as hemoglobinopathies, anemia, and pregnancy, which are common in many African populations[6]. In such cases, FPG or oral glucose tolerance test may be more appropriate for diagnosis.

The World Health Organization recommended the use of HbA1c for diabetes diagnosis, noting that it provides a more reliable assessment of chronic glycemia than FPG. However, the WHO also acknowledged that HbA1c assays are not universally available, particularly in resource-limited settings, and that quality assurance is essential for accurate results. The organization recommended that countries establish their own quality-controlled HbA1c assays before adopting HbA1c as a diagnostic criterion.

In addition to diagnosis, glycemic markers are essential for monitoring diabetes treatment. The ADA recommends a target HbA1c of < 7% for most non-pregnant adults, though more or less stringent targets may be appropriate for individual patients based on factors such as age, comorbidities, and risk of hypoglycemia. Regular monitoring of HbA1c (every 3-6 months) allows for timely adjustment of treatment strategies to achieve and maintain glycemic targets[7].

Conceptual Framework

Diabetes Management and Prevention Strategies

The management of type 2 diabetes mellitus involves a comprehensive approach including lifestyle modifications, pharmacological therapy, and regular monitoring of glycemic control and complications. The ADA Standards of Medical Care in Diabetes provide evidence-based recommendations for diabetes management, with goals of achieving glycemic control, reducing cardiovascular risk, and preventing complications.

Lifestyle interventions focusing on diet, physical activity, and weight loss remain the cornerstone of diabetes prevention and management. The Diabetes Prevention Program demonstrated that intensive lifestyle intervention reduced the risk of progression from prediabetes to diabetes by 58%, compared to 31% with metformin[8][9]. The lifestyle intervention included a goal of at least 7% weight loss and 150 minutes of physical activity per week. The DPP Lifestyle Change Program was effective across all racial and ethnic groups and both sexes, with particular efficacy in participants aged 60 and older, reducing their risk of developing type 2 diabetes by 71%. A 10-year follow-up study showed that participants were still one-third less likely to develop type 2 diabetes a decade later than individuals in placebo groups, and those who did develop diabetes delayed the onset by about 4 years.

For individuals with established diabetes, medical nutrition therapy is recommended to promote healthy eating patterns that achieve glycemic targets, reduce cardiovascular risk, and support weight management. There is no single “diabetic diet” that is optimal for all patients; rather, individualized meal plans should be developed based on the patient’s preferences, cultural practices, and metabolic goals. The 2024 ADA Standards of Care emphasize food-based eating styles that incorporate healthy fats and Mediterranean-style eating patterns, with new guidance on religious and time-restricting fasting. Carbohydrate counting, the plate method, and Mediterranean-style eating patterns are all effective approaches. Protein intake goals should be individualized, with the 2024 ADA Standards stating there is no evidence that adjusting daily protein intake (typically 1–1.5 g/kg body weight/day) will improve health in individuals without diabetic kidney disease. Those with diabetic kidney disease should maintain dietary protein at no more than 0.8 g/kg desirable body weight/day.

Physical activity is another essential component of diabetes management. The ADA recommends at least 150 minutes per week of moderate-intensity aerobic activity, spread over at least three days per week, with no more than two consecutive days without activity. Resistance training is also recommended at least twice per week. Physical activity improves insulin sensitivity, promotes weight loss, reduces cardiovascular risk, and improves overall well-being.

Pharmacological therapy for type 2 diabetes includes various classes of medications targeting different aspects of the disease pathophysiology. Metformin remains the first-line therapy for most patients due to its efficacy, safety, low cost, and potential cardiovascular benefits. When metformin alone is insufficient to achieve glycemic targets, additional agents may be added, including sulfonylureas, DPP-4 inhibitors, GLP-1 receptor agonists, SGLT2 inhibitors, thiazolidinediones, and insulin.

Anthropometric Indices in African Populations

The performance of anthropometric indices in predicting diabetes risk may vary across ethnic groups due to differences in body composition, fat distribution patterns, and genetic factors. Several studies have examined the utility of various anthropometric measures in African populations, providing valuable insights into their applicability in these settings.

The study documented that the odds ratios for T2DM per standard deviation higher level were 2.04 for WHtR, 1.98 for WHR, and 1.88 for BRI, indicating that these indices are strong predictors of diabetes in this population. The authors also found that novel indices such as ABSI and VAI showed significant associations with diabetes risk, though their predictive performance was not superior to simpler measures like WHtR. The authors concluded that novel anthropometric indices, particularly WHtR and BRI, offer practical and effective tools for diabetes screening in resource-limited settings.

Musa[10] assessed the ability of anthropometric indices in detecting type 2 diabetes mellitus in Sudanese adults. Their cross-sectional study of 396 adults found that BMI, WHtR, and WC had poor to fair predictability in detecting T2DM, with AUC values of 0.55, 0.62, and 0.63 respectively. The optimal

cutoff points identified were 25.17 kg/m² for BMI, 0.44 for WHtR, and 79.28 cm for WC, which differ from those established in Western populations.

The study found that WHtR and WC performed better than BMI in detecting T2DM, consistent with findings from other populations. However, the optimal cutoff values were lower than those recommended for Western populations, suggesting that lower thresholds may be appropriate for diabetes screening in Sudanese adults. The authors recommended that population-specific cutoff values should be established for effective diabetes screening in African populations.

Issaka examined associations between obesity indices and both type 2 diabetes and impaired fasting glucose among West African adults using WHO STEPS survey data from Ghana and Burkina Faso. Their study included over 7,000 participants and found that obesity defined using waist circumference and BMI showed the strongest associations with diabetes risk. The study also found that the associations between anthropometric measures and diabetes risk were stronger in urban compared to rural areas, reflecting the influence of lifestyle factors[11].

Sirisena, Okeahialam[12] investigated the association of obesity anthropometric indices with hypertension, diabetes mellitus, and hypertriglyceridemia in an apparently healthy adult Nigerian population. Their study included 500 adults and demonstrated significant associations between various anthropometric measures and cardiometabolic risk factors. The authors found that WHtR was the strongest predictor of diabetes risk among the indices studied, supporting its use as a screening tool in Nigerian populations[13].

Anthropometric Indices and Type 2 Diabetes Mellitus

Traditional Anthropometric Indices

Body mass index (BMI) is the most widely used measure of overall obesity and is calculated as weight in kilograms divided by height in meters squared. The World Health Organization defines underweight as BMI < 18.5 kg/m², normal weight as 18.5-24.9 kg/m², overweight as 25-29.9 kg/m², and obesity as BMI ≥ 30 kg/m². While BMI is strongly associated with diabetes risk, it does not distinguish between fat and lean mass or account for fat distribution, which is an important determinant of metabolic risk.

Despite its limitations, BMI remains a useful tool for population-level assessment of obesity and diabetes risk[14]. Large epidemiological studies have consistently demonstrated a strong association between BMI and diabetes risk, with the risk increasing progressively as BMI increases above the normal range[15]. However, the relationship between BMI and diabetes risk may vary across ethnic groups, with some populations developing diabetes at lower BMI levels than others.

Waist circumference (WC) is a simple measure of central obesity that reflects visceral adipose tissue accumulation. Excess visceral fat is particularly strongly associated with insulin resistance and diabetes risk because it is metabolically active and releases free fatty acids and inflammatory cytokines directly into the portal circulation. The IDF recommends ethnic-specific cutoff values for WC, with values > 94 cm for men and > 80 cm for women indicating increased cardiometabolic risk in Europid populations. However, lower cutoffs may be appropriate for Asian and African populations.

The waist-to-hip ratio (WHR) is another measure of body fat distribution that accounts for both waist and hip circumferences. WHR reflects the proportion of abdominal fat to gluteofemoral fat, with higher values indicating greater central obesity. Values > 0.90 for men and > 0.85 for women are generally considered to indicate increased cardiometabolic risk. WHR has been shown to predict diabetes risk independent of BMI, highlighting the importance of fat distribution beyond overall obesity.

Glycated Hemoglobin (HbA1c)

Glycated hemoglobin (HbA1c) refers to hemoglobin that has undergone non-enzymatic glycation at the

N-terminal valine residue of the β-chain, with the percentage of glycated hemoglobin reflecting average blood glucose concentration over the preceding 8-12 weeks (the lifespan of red blood cells). The World Health Organization endorsed HbA1c ≥6.5% (48 mmol/mol) as a diagnostic criterion for diabetes when standardized assays traceable to the DCCT reference are employed. HbA1c serves as the primary metric for glycemic control monitoring, with the American Diabetes Association recommending a target of <7% (53 mmol/mol) for most non-pregnant adults, while acknowledging that individualization is necessary based on patient characteristics, comorbidities, and hypoglycemia risk. Limitations of HbA1c include conditions affecting red blood cell lifespan (hemoglobinopathies, anemia, pregnancy) and ethnic variations in glycation rates that may affect interpretation in specific populations.

Metabolic Syndrome

Metabolic syndrome is defined as a cluster of interrelated metabolic risk factors that increase the risk of cardiovascular disease, T2DM, and all-cause mortality. Diagnostic criteria require the presence of at least three of five components: elevated waist circumference (population-specific thresholds), elevated triglycerides (≥150 mg/dL), reduced HDL cholesterol (<40 mg/dL in men, <50 mg/dL in women), elevated blood pressure (≥130/85 mmHg), and elevated fasting glucose (≥100 mg/dL or 5.6 mmol/L). The American Diabetes Association recognizes metabolic syndrome as a predictor of diabetes and cardiovascular disease, though it emphasizes that the syndrome represents a constellation of risk factors rather than a distinct pathophysiological entity. The concept underscores the interconnected nature of anthropometric and biochemical abnormalities in T2DM pathogenesis.

Diabetic Complications

Diabetic complications encompass the macrovascular and microvascular pathologies that arise from chronic hyperglycemia and associated metabolic disturbances. Macrovascular complications include coronary artery disease, cerebrovascular disease, and peripheral artery disease, driven by accelerated atherosclerosis. Microvascular complications include diabetic retinopathy (damage to retinal blood vessels potentially causing vision loss), diabetic nephropathy (progressive kidney disease culminating in end-stage renal disease), and diabetic neuropathy (damage to peripheral and autonomic nerves). The coexistence of multiple complications, such as concurrent retinopathy and nephropathy, is associated with worse clinical outcomes than isolated complications[16]. The biochemical and anthropometric variations under investigation in this study serve as predictors, mediators, and potentially modifiable risk factors for these complication developments.

Pharmacologic Approaches to Glycemic Treatment

Pharmacologic approaches to glycemic treatment encompass the diverse classes of medications employed to lower blood glucose and manage T2DM. First-line therapy typically involves metformin, which reduces hepatic glucose production and improves insulin sensitivity. Second-line options include sulfonylureas (stimulating insulin secretion), thiazolidinediones (improving insulin sensitivity), DPP-4 inhibitors (enhancing incretin action), GLP-1 receptor agonists (stimulating glucose-dependent insulin secretion, suppressing glucagon, promoting satiety), SGLT2 inhibitors (promoting urinary glucose excretion), and various insulin preparations. The American Diabetes Association emphasizes individualized selection based on efficacy, hypoglycemia risk, effects on weight and cardiovascular/renal outcomes, cost, and patient preferences. SGLT2 inhibitors and GLP-1 RAs with demonstrated cardiovascular and renal benefits are preferred for patients with established atherosclerotic cardiovascular disease, heart failure, or chronic kidney disease[17].

Population-Specific Risk Thresholds

Population-specific risk thresholds acknowledge that universal cut-points for anthropometric and

biochemical parameters may inadequately capture metabolic risk across diverse ethnic, geographic, and genetic populations. Evidence demonstrates that BMI and waist circumference values associated with equivalent diabetes risk vary between populations, with some Asian and African populations developing metabolic disease at lower BMI thresholds than European populations. The World Health Organization STEPS surveillance manual recommends population-specific validation of risk thresholds while maintaining standardized measurement protocols to enable cross-population comparisons. Issaka documented that West African adults exhibit distinct associations between obesity indices and diabetes risk compared to other populations, supporting the need for region-specific characterization of anthropometric-biochemical relationships. Bruno, Sirisena, Okeahialam provided Nigerian-specific data, though these studies focused on Northern and mixed Nigerian populations rather than the specific context of Owerri in Southeastern Nigeria.

Methodology

In carrying out this study comparative cross-sectional study was adopted. The study population consisted of one hundred (100) diagnosed type 2 diabetic patients and one hundred (100) apparently healthy, age- and sex-matched non-diabetic individuals who served as controls. All participants were aged between 30 and 70 years. Ten (10) mL of venous blood samples were collected from each participant after overnight fast using standard aseptic procedures and distributed into appropriate tubes for the determination of fasting plasma glucose (FPG), glycated hemoglobin (HbA1c), insulin, lipid profile, and oxidative stress markers. Serum and plasma were prepared by centrifugation at 3000 rpm for 10 minutes, while whole blood was used for selected analyses. The samples were analyzed using standard laboratory methods. Data obtained were analyzed using Statistical Package for Social Sciences (SPSS) version 25.0.

Results and Discussion

Pearson Correlation between Glycemic Parameters and Anthropometric Parameters in Type 2 Diabetic Patients

There were significant negative correlations of fasting plasma glucose (FPG) with body mass index (BMI) ($r = -0.216^*$, $p = 0.031$) and waist-to-hip ratio (WHR) ($r = -0.205^*$, $p = 0.041$) in type 2 diabetic patients.

There was a significant positive correlations of fasting plasma glucose (FPG) with body roundness index (BRI) ($r = 0.211^*$, $p = 0.035$) in type 2 diabetic patients.

Glycated hemoglobin (HbA1c) and insulin levels showed no significant correlation with anthropometric parameters in type 2 diabetic patients (Table 4.5.1).

Table 1. Pearson Correlation between Glycemic Parameters and Anthropometric Parameters in Type 2 Diabetic Patients

		FPG	HbA1c	Insulin	BMI	WC	WHR	WHtR	BRI	VAI
	r-value	1	.215*	.056	-.216*	-.095	-.205*	.018	.211*	.179
FPG	p-value		.032	.578	.031	.345	.041	.863	.035	.074
	n	100	100	100	100	100	100	100	100	100
	r-value	.215*	1	.078	-.110	.195	.130	.021	.171	-.076
HbA1c	p-value	.032		.439	.274	.052	.197	.834	.089	.452
	n	100	100	100	100	100	100	100	100	100
Insulin	r-value	.056	.078	1	.026	-.055	-.003	-.148	.010	-.176

	p-value	.578	.439		.796	.587	.973	.142	.923	.079
	n	100	100	100	100	100	100	100	100	100
	r-value	-.216*	-.110	.026	1	.022	-.225*	.156	.031	-.043
BMI	p-value	.031	.274	.796		.826	.024	.121	.759	.667
	n	100	100	100	100	100	100	100	100	100
	r-value	-.095	.195	-.055	.022	1	-.141	.017	-.085	.155
WC	p-value	.345	.052	.587	.826		.162	.867	.402	.124
	n	100	100	100	100	100	100	100	100	100
	r-value	-.205*	.130	-.003	-.225*	-.141	1	-.105	.187	.047
WHR	p-value	.041	.197	.973	.024	.162		.297	.062	.639
	n	100	100	100	100	100	100	100	100	100
	r-value	.018	.021	-.148	.156	.017	-.105	1	-.227*	.036
WHtR	p-value	.863	.834	.142	.121	.867	.297		.023	.725
	n	100	100	100	100	100	100	100	100	100
	r-value	.211*	.171	.010	.031	-.085	.187	-.227*	1	.143
BRI	p-value	.035	.089	.923	.759	.402	.062	.023		.156
	n	100	100	100	100	100	100	100	100	100
	r-value	.179	-.076	-.176	-.043	.155	.047	.036	.143	1
VAI	p-value	.074	.452	.079	.667	.124	.639	.725	.156	
	n	100	100	100	100	100	100	100	100	100

Key: r = Pearson Correlation

* Correlation is significant at the 0.05 level

Anthropometric indices are crucial indicators of metabolic health, reflecting the degree of adiposity and its distribution, which are inherently linked to the development of insulin resistance. The findings of this study showed that body mass index (BMI) was significantly higher in type 2 diabetic patients compared to controls. This increase is primarily driven by an energy imbalance where calorie intake exceeds physical expenditure, often exacerbated by the rapid urbanization and shift toward sedentary occupations in Imo State. Mechanistically, elevated BMI indicates a greater degree of overall adiposity among the diabetic group. Increased body mass index is strongly associated with insulin resistance, as excess adipose tissue, particularly in obese individuals, leads to the release of free fatty acids, pro-inflammatory cytokines, and adipokines that impair insulin signaling pathways. Additionally, enlarged adipocytes exhibit reduced insulin sensitivity, further exacerbating hyperglycemia. This finding is consistent with previous studies that have reported higher body mass index values among individuals with type 2 diabetes. Previous observations in Owerri by Ezeama, Enwereji also noted that a large majority of diabetic patients in the region were overweight or obese, particularly among civil servants with sedentary lifestyles.

Glycated hemoglobin and insulin levels showed no significant correlations with anthropometric parameters in this study. The lack of association may indicate that long-term glycemic control and circulating insulin levels are influenced by multiple factors beyond body composition, including duration of diabetes, medication use, and individual variability in β-cell function[18]. This finding is in line with some previous studies that have reported weak or non-significant relationships between HbA1c and anthropometric indices in diabetic populations, although others have found significant associations depending on study design and population characteristics.

Conclusion

The study concluded that there is a significant relationship between fasting plasma glucose (FPG) and some anthropometric parameters among patients with type 2 diabetes mellitus. Specifically, FPG showed significant negative correlations with BMI and WHR, while a significant positive correlation was observed with BRI. However, HbA1c and insulin showed no significant correlations with the anthropometric parameters assessed, including BMI, WC, WHR, WHtR, BRI, and VAI. These findings indicate that different glycemic parameters may relate differently to measures of body size and fat distribution among patients with type 2 diabetes mellitus. Therefore, the combined assessment of glycemic and anthropometric parameters may provide useful information for monitoring metabolic status and identifying factors associated with glycemic control in diabetic patients. Patients with type 2 diabetes mellitus should undergo regular assessment of FPG, HbA1c, and appropriate anthropometric parameters to facilitate effective monitoring of glycemic and metabolic status. Healthcare professionals should encourage appropriate lifestyle practices, including healthy dietary habits, regular physical activity, and adherence to prescribed diabetes treatment, to support optimal glycemic control and healthy body composition. Further studies with larger sample sizes and longitudinal designs should be conducted to better establish the relationship between glycemic parameters and anthropometric indices among patients with type 2 diabetes mellitus.

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