

A Cross-Sectional Analysis of Body Mass Index and Fasting Blood Sugar Levels among Urban Elite Adult Population

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Abstract: Background: Diabetes mellitus is a growing global health challenge strongly associated with obesity. While both elevated fasting blood sugar (FBS) and increased Body Mass Index (BMI) are independently linked to type 2 diabetes mellitus, evidence regarding a direct relationship between BMI and FBS remains inconsistent. Urban elite populations, characterized by affluence, sedentary lifestyles, and dietary transitions, may exhibit unique metabolic patterns. This study assessed the relationship between BMI and FBS among an adult urban elite population in Onitsha, Nigeria.

Methods: A cross-sectional study was conducted among 96 consenting Knights and Ladies of the Anglican Communion, at Onitsha. Sociodemographic data, anthropometric measurements, blood pressure, and fasting blood sugar were obtained using standardized procedures. BMI was calculated from measured height and weight, and FBS was assessed using a Double G glucometer. Data were analyzed using SPSS version 27. Independent samples t-tests compared mean values by gender, while Pearson's correlation coefficient evaluated the relationship between BMI and FBS. Statistical significance was set at $p < 0.05$.

Results: Participants had a mean age of 61.35 ± 10.3 years; 54.2% were female. The mean BMI was 30.4 ± 3.87 kg/m², indicating obesity, and the mean FBS was 114.2 ± 29.71 mg/dl, reflecting impaired fasting glucose. Males had significantly higher FBS than females (123.7 vs. 106.19 mg/dl, $p = .003$), while females had significantly higher BMI (31.85 vs. 28.68 kg/m², $p < .001$). Pearson's correlation analysis showed no significant relationship between BMI and FBS ($r = -.095$, $p = .357$).

Conclusion: Despite high levels of obesity and impaired fasting glucose in this urban elite population, BMI did not correlate with fasting blood sugar. These findings suggest that BMI alone may not be a reliable predictor of glycaemic status in older, socioeconomically advantaged adults. Measures of central obesity may offer better predictive value and should be prioritized in future research.

Keywords: Body Mass Index, Fasting Blood Sugar, type 2 Diabetes mellitus, urban population, obesity.

1. INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder with increasing global prevalence, particularly linked to obesity.¹ Obesity, measured by Body Mass Index (BMI), significantly heightens the risk of type 2 diabetes and is the most important modifiable risk factor in the pathogenesis of type 2 diabetes.² The urban elite population is predisposed to having high body mass index as a result of affluence, change in diet and sedentary life.³ Much work has been done on relationship between diabetes mellitus and BMI and a clear relationship exists but there is no clear relationship between BMI and blood sugar level. This work aims at studying the relationship between BMI and fasting blood sugar level in an adult urban elite population.

2. REVIEW OF LITERATURE

The prevalence of Type 2 Diabetes Mellitus (DM) is rising in Nigeria.⁴ It is a chronic non-communicable disease that cannot be treated but managed.⁵ Approximately 425 million people are living with DM⁶ worldwide. In sub-Saharan Africa, including Nigeria, about 90% of type 2 diabetes is attributable to excess weight.⁷ About 197 million people worldwide have impaired glucose tolerance most commonly because of obesity and the associated metabolic syndrome.⁷ Prevalence of DM is rising because of factors that include obesity and physical inactivity.⁸ Diabetes Mellitus has very strong positive correlation with Blood Sugar. Fasting Blood Sugar (FBS) is diagnostic tool for DM. $FBS \geq 126$ mg/dl is diagnostic of DM.⁹ DM also has very strong positive relationship with Body Mass index (BMI).⁴ Increase in the prevalence of type 2 diabetes is closely linked to the upsurge in obesity.⁹ It is thus established that DM has a positive relationship with blood sugar and BMI.

There is a gap in knowledge as regards the relationship between blood sugar and BMI. Some researchers report no significant relationship,^{11,12,13,14,15} while others report significant relationship.¹⁶ Some report significant relationship in females only.¹⁷

Elites in urban residence belong to the high socioeconomic class.¹⁸ Obesity is known to be associated with high socioeconomic class and Urban residence.³ The aim of this work is to study the relationship between BMI and FBS in an urban elite population.

3. METHODS

Study Design and Setting

This cross-sectional study was conducted in Onitsha, Anambra State, Nigeria—an urban commercial hub characterized by a high concentration of business executives, professionals, and religious leaders. The study population comprised Knights and Ladies of the Anglican Communion, who attended a retreat on 14 February 2026.

Study Population and Sampling

The nominal roll listed approximately 350 members. All individuals present at the retreat were invited to participate. Inclusion required provision of written informed consent; those who declined were excluded. A total of 96 participants met the inclusion criteria and were enrolled.

Data Collection Instruments and Procedures

Data were collected using an interviewer-administered questionnaire and standardized measurement protocols. Ten trained research assistants obtained information on sociodemographic characteristics and self-reported medical history, including hypertension and diabetes mellitus.

Anthropometric Measurements

- **Height:** Measured to the nearest 0.1 cm using a wall-mounted improvised stadiometer calibrated with a measuring tape. Participants stood barefoot, heels together, back against the wall, and head in the Frankfurt plane.
- **Weight:** Measured to the nearest kilogram using a Hanson Emperors Bathroom Scale, zeroed before each use. Participants wore light clothing and removed heavy accessories.
- **BMI Calculation:** BMI was computed as weight (kg) divided by height squared (m^2).

Blood Pressure Measurement

Blood pressure was measured using a mercury sphygmomanometer. Three readings were taken at three-minute intervals with participants seated and the arm supported at heart level. The average of the last two readings was recorded. Hypertension was defined as systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg,¹⁹ or a prior diagnosis of hypertension under treatment.

Fasting Blood Sugar Measurement

Fasting blood sugar (FBS) was assessed using the Double G blood glucose meter. After cleaning the thumb with a spirit swab, a lancet was used to obtain a capillary blood sample. The test strip was applied to the blood droplet, and the glucose

value displayed after 5 seconds was recorded. FBS \geq 126 mg/dl was classified as diabetes mellitus.^{9, 10} Participants with known diabetes on treatment were also classified as diabetic regardless of measured FBS.

Data Management and Statistical Analysis

Data were analyzed using SPSS version 27. Descriptive statistics (means, standard deviations, frequencies, and percentages) summarized participant characteristics. Independent samples t-tests compared mean FBS and BMI between males and females. Chi-square tests assessed associations between categorical variables. Pearson’s correlation coefficient evaluated the relationship between BMI and fasting blood sugar. Statistical significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the Health Research Ethics Committee of Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, Awka (COOUTH/HERC/Vol.II/FN:05/03). Written informed consent was obtained from all participants, with assurances of confidentiality and anonymity.

4. RESULTS

Of the 96 subjects that met the inclusion criteria, 44 (45.8%) were males and 52 (54.2%) were females. Majority 82 (85.4%) were married and 53 (55.2%) had tertiary education. The commonest symptom the participants complained of was blurred vision 15 (15.6%) while the majority 51 (53.1%) did not complain of any symptom. Their mean age was 61.35 years \pm 10.3. Males had a mean age of 63.43 years \pm 9.42 and females 59.62 years \pm 10.76. The distribution of the participants by marital status, education, employment and symptoms is as shown in **Table 1**.

Table 1. Sociodemographic characteristics of participants

Characteristic		Frequency (%)
Gender	Male	44 (45.8)
	Female	52 (54.2)
Marital status	Married	82 (85.4)
	Widow	13 (13.5)
	Widower	1 (1.0)
Education	Primary	8 (8.3)
	Secondary	18 (18.8)
	Tertiary	53 (55.2)
	Post graduate	17 (17.7)
Employment	self-employed	38 (39.6)
	Employed (Public sector)	16 (16.7)
	Employed (private sector)	11 (11.5)
	Retired	31 (32.3)
Symptoms	None	51 (53.1)
	excessive thirst	1 (1.0)
	frequent urination	6 (6.3)
	unusual tiredness	8 (8.3)
	Blurred vision	15 (15.6)
	Unintentional weight loss	3 (3.1)
	Frequent urination and Unusual tiredness	2 (2.1)
	Excessive thirst, frequent	
	Urination, blurred vision	1 (1.0)
	Frequent urination, blurred vision	4 (4.2)
Unusual tiredness, blurred vision	2 (2.1)	

The mean FBS was 114.2 mg/dl \pm 29.71. Males had mean FBS of 123.7 \pm 39.75 and females 106.19 \pm 12.98, $t = -2.997$, $p = .003$.

The BMI of the participants was 30.4 ± 3.87 . Males had BMI of 28.68 ± 2.92 while females had 31.85 ± 4.01 , $t = 4.35$, $p < .001$. Correlation study on FBS and BMI shows $r = -.095$, $p = .357$. There is no correlation between FBS and BLI. See **Figure 1** below.

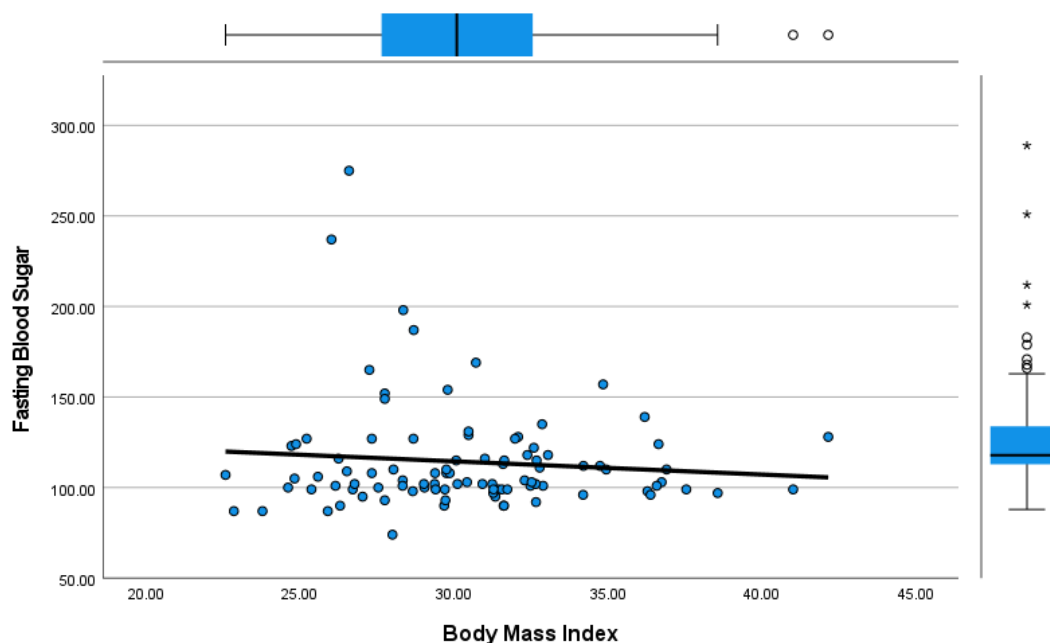


Figure 1. Regression plot showing correlation between FBS and BMI

Table 2 below shows the exact correlation values

		Body Mass Index	Fasting Blood Sugar
Body Mass Index	Pearson Correlation	1	-.095
	Sig. (2-tailed)		.357
	N	96	96
Fasting Blood Sugar	Pearson Correlation	-.095	1
	Sig. (2-tailed)	.357	
	N	96	96

5. DISCUSSION

This study set out to examine the relationship between Body Mass Index (BMI) and fasting blood sugar (FBS) among an urban elite adult population in Onitsha, Nigeria. Although diabetes mellitus is known to correlate strongly with both hyperglycaemia and obesity,^{4, 10, 20} the present study found no significant relationship between BMI and fasting blood sugar ($r = -.095$, $p = .357$). This finding challenges the intuitive expectation that higher BMI should be associated with higher fasting glucose levels, given the well-established role of obesity in the pathogenesis of type 2 diabetes mellitus. The absence of correlation aligns with several previous studies that similarly reported no significant association between BMI and blood glucose levels.^{11, 12, 21, 22} However, other studies have demonstrated a positive correlation,^{23, 24, 25, 26} and some have even identified gender-specific associations.¹⁷ This inconsistency in the literature suggests that the relationship between BMI and glycaemic status is more complex than previously assumed and may be influenced by additional metabolic, demographic, or behavioural factors.

One plausible explanation for the lack of correlation in this study is the homogeneity of the sample. The participants were predominantly older adults with a mean age of 61.35 years and were already characterized by both impaired fasting glucose (mean FBS 114.2 mg/dl) and obesity (mean BMI 30.4 kg/m²). This clustering around high BMI and elevated glucose levels reduces variability and may obscure potential associations. A broader sample including younger adults, normal-weight individuals, and those with wider metabolic diversity might yield different results.

Another important consideration is the limitation of BMI as a measure of adiposity. BMI does not distinguish between fat and lean mass, nor does it capture fat distribution. Central obesity—measured by waist circumference or waist-to-hip ratio—is increasingly recognized as a more accurate predictor of metabolic risk.²⁷ Indeed, visceral fat is more metabolically active and more strongly associated with insulin resistance than overall body mass.²⁸ Studies have shown that even individuals with normal BMI but high central adiposity may have elevated diabetes risk.²⁹

The findings of this study therefore reinforce the growing consensus that BMI alone may be insufficient for predicting glycaemic abnormalities, particularly in populations with high baseline obesity. The urban elite population studied here may also have unique lifestyle patterns—such as high-calorie diets, sedentary occupations, and stress-related metabolic changes—that influence blood glucose independently of BMI.

Finally, the gender differences observed—higher FBS in males and higher BMI in females—highlight the need for gender-sensitive metabolic research. Although this study did not find gender-specific correlations, other studies have reported such patterns, suggesting that hormonal, behavioural, or body-fat distribution differences may play a role.

In summary, this study contributes to the ongoing debate regarding the utility of BMI as a predictor of glycaemic status. While obesity remains a major risk factor for type 2 diabetes, BMI may not reliably reflect the metabolic risk profile of all individuals, particularly in older, urban, and socioeconomically advantaged populations. Future research incorporating central obesity measures and more diverse samples is warranted to clarify these relationships.

6. CONCLUSION

This study examined the relationship between Body Mass Index (BMI) and fasting blood sugar (FBS) among an urban elite adult population in Onitsha, Nigeria. Although both obesity and hyperglycaemia are well-established risk factors for type 2 diabetes mellitus, the findings of this study demonstrate no significant correlation between BMI and fasting blood sugar in this population. The participants were predominantly older adults who were already obese and had impaired fasting glucose levels, suggesting a metabolic profile in which BMI alone may no longer be a sensitive indicator of glycaemic variation. These results align with several previous studies reporting no direct association between BMI and blood glucose, highlighting the complexity of metabolic risk assessment and the limitations of BMI as a sole predictor of glycaemic status. Overall, the findings underscore the need for more nuanced anthropometric and metabolic markers when evaluating diabetes risk in urban, socioeconomically advantaged populations.

7. RECOMMENDATIONS

1. Use central obesity measures in future research:

Given the limitations of BMI, future studies should incorporate waist circumference, waist-to-hip ratio, or other measures of visceral adiposity, which may better reflect metabolic risk and insulin resistance.

2. Expand the study population:

Including younger adults, normal-weight individuals, and participants from diverse socioeconomic backgrounds may provide a broader distribution of BMI and FBS values, allowing clearer assessment of potential correlations.

3. Conduct longitudinal studies:

A prospective design would help determine whether changes in BMI or central obesity predict future changes in fasting blood sugar or progression to diabetes.

4. Integrate lifestyle and metabolic variables:

Factors such as diet, physical activity, stress levels, lipid profile, and family history should be included to better understand the multifactorial determinants of glycaemic status.

5. Promote targeted health interventions:

Given the high prevalence of obesity and impaired fasting glucose in this population, tailored health education, lifestyle modification programs, and routine metabolic screening are recommended to prevent progression to overt diabetes.

REFERENCES

- [1] Younis MB, Younis MB. Prevalence and associated factors of obesity, diabetes, and hypertension among university students in Jordan. *Obesity Medicine*. 2026;59:100663. doi.org/10.1016/j.obmed.2025.100663.
- [2] Chandrasekaran P, Weiskirchen R. The Role of Obesity in Type 2 Diabetes Mellitus-An Overview. *Int J Mol Sci*. 2024 Feb 4;25(3):1882. doi: 10.3390/ijms25031882. PMID: 38339160; PMCID: PMC10855901.
- [3] Agrawal P, Gupta K, Mishra V, Agrawal S. Effects of sedentary lifestyle and dietary habits on body mass index change among adult women in India: findings from a follow-up study. *Ecol Food Nutr*. 2013;52(5):387-406. doi: 10.1080/03670244.2012.719346. PMID: 23927045; PMCID: PMC5562270.
- [4] Olamoyegun MA, Alare K, Afolabi SA, Aderinto N, Adeyemi T. A systematic review and meta-analysis of the prevalence and risk factors of type 2 diabetes mellitus in Nigeria. *Clin Diabetes Endocrinol*. 2024 Dec 6;10(1):43. doi: 10.1186/s40842-024-00209-1. PMID: 39639395; PMCID: PMC11622640.
- [5] Wardian JL. Diabetes Cannot Be Controlled, But It Can Be Managed. *Clin Diabetes*. 2017 Dec;35(5):329-330. doi: 10.2337/cd16-0061. PMID: 29263576; PMCID: PMC5734180.
- [6] Federation ID. *IDF Diabetes Atlas Eighth edition 2017*. International Diabetes Federation. IDF Diabetes Atlas. 8th edn. Brussels, Belgium: International Diabetes Federation, 2017.
- [7] Hossain P, Kavar B, El Nahas M. Obesity and diabetes in the developing world—a growing challenge. *New Engl j med*. 2007 Jan 18;356(3):213-5. doi:10.1056/nejmp068177.
- [8] Wild S, Roglic G, Green A, et al. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diab care*. 2004 May 1;27(5):1047-53. doi: 10.2337/diacare.27.5.1047.
- [9] Akintayo-Usman NO, Okanlawon FA, Usman SO. Prevalence of pre-diabetes and risk factors among secondary school adolescents in Osogbo Local Government Area, Osun State, Nigeria. *Afr Heal Sci*. 2021 Sep 27;21(3):1301-9. doi: 10.4314/2Fahs.v21i3.41
- [10] Magliano DJ, Boyko EJ, Atlas ID. What is diabetes? In *IDF DIABETES ATLAS* [Internet]. 10th edition 2021. International Diabetes Federation.
- [11] Maghriba G, Damayanti A. The Relationship Between Body Mass Index and Blood Sugar Levels in Students of the Faculty of Medicine, University of Muhammadiyah North Sumatera 2021. *phms* [Internet]. 2025 Nov. 22;3(1):8. Available from: <https://digital-science.pubmedia.id/index.php/phms/article/view/526>.
- [12] Etukumana E A, Puepet FH, Obadofin MO. Relationship between random blood glucose levels and body mass index among rural adults in North central Nigeria. *Ibom Medical Journal*. 2013;6(1):37-41.
- [13] Bakari AG, Onyemelukwe C, Sani BG, Aliyu S, Hassan SS, Aliyu TM. Relationship between casual blood sugar and body mass index in a suburban northern Nigerian population: a short communication. *Niger J Med*. 2007 Jan-Mar;16(1):77-8. doi: 10.4314/njm.v16i1.37287. PMID: 17563975.
- [14] Hossain S, Chowdhury AI, Sarwer MN, Akter F, Mukta NA. Association Between Blood Glucose and Body Mass Index with Dietary Diversity and Physical Activity: A Cross-Sectional Study on Marma Tribes of Bandarban in Bangladesh. *Health Sci Rep*. 2025 Jul 23;8(7):e71113. doi: 10.1002/hsr2.71113. PMID: 40709073; PMCID: PMC12287539.
- [15] Yuliawuri H, Handoko SM, Simarmata AK, Wibowo J. Correlation between body mass index (BMI) and blood glucose level among people in RMCI Jakarta: A cross-sectional study. *midwifery* [Internet]. 2024 Aug. 31;12(3):1381-6. Available from: <https://midwifery.iocspublisher.org/index.php/midwifery/article/view/1642>.
- [16] Daradkeh G, Calapano M, Acido H, Rustom M, Kajayon C, Al-Muhannadi A. Body Mass Index (BMI) correlate with blood glucose level in the state of Qatar. *Open Access Research Journal of Multidisciplinary Studies*. 2021;02(1):5–12.
- [17] Onyesom I, Oweh OT, Etumah OS, Ifie EJ. Correlation between body mass index and blood glucose levels among some Nigerian undergraduates. *HOAJ Biology*. January 2013;2(1):1-7.

- [18] Oyedeji GA. Socio-economic and cultural background of hospitalized children in Ilesha. *Global Journal of Health Science*. 1985;12:111-117.
- [19] World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/hypertension>. Assessed 2nd February 2026.
- [20] Bays HE, Chapman RH, Grandy S; SHIELD Investigators' Group. The relationship of body mass index to diabetes mellitus, hypertension and dyslipidaemia: comparison of data from two national surveys. *Int J Clin Pract*. 2007 May;61(5):737-47. doi: 10.1111/j.1742-1241.2007.01336.x.
- [21] Vargese SS, Joseph T, Mathew E. Relationship between fasting blood glucose and body mass index among students of a medical college. *J. Biomed. Sci.* [Internet]. 2019 Dec. 24;6(3):23.
- [22] Rimadhani ET, Mawardi F, Dewi FP, Purwanta DB, Sholikah A, Hutomo MA. The relationship of body mass index with fasting blood glucose in type-2 diabetes mellitus. *BIO Web Conf*. 2024; **148**, 01018. DOI: <https://doi.org/10.1051/bioconf/202414801018>
- [23] Vital BG, Praveen G, Deepak P. A study of body mass index in healthy individuals and its relationship with fasting blood sugar. *Journal of Clinical and Diagnostic Research*. 2010;4(6):3421-3424.
- [24] Deng L, Jia L, Wu XL, Cheng M. Association Between Body Mass Index and Glycemic Control in Type 2 Diabetes Mellitus: A Cross-Sectional Study. *Diabetes Metab Syndr Obes*. 2025 Feb 21;18:555-563. doi: 10.2147/DMSO.S508365. PMID: 40007519; PMCID: PMC11853989.
- [25] Doustjalali SR, Sabet NS, Muhammadeffs Amm A, Sreemathi K, Abdulazizaz Linn NH, Zin KS, Kumar SS, Dar HT, Khinthane O, Wong RS, Wwl S, Ramli N, Low S, Muftahabudusalam Elbahloul, Yusuf AA, Desa MN, Mhm N, Al-Jashamy KA, Taha A, Khalaf & Hussaini J. (2020). Correlation between Body Mass Index (BMI) and Fasting Blood Glucose (FBG) Level among Malaysian Adults. *P J M H S*. 2020;14(3):1371 – 1375.
- [26] Silulu H, Simak V, Renteng S. The relationship between body mass index and waist circumference with fasting blood glucose in productive-age women in Idamgamlamo village. *JKEP*. 2025;10(2):117-122. <https://doi.org/10.32668/jkep.v10i2.1986>
- [27] Joshi B, Shrestha L, Bhattarai K, Manandhar N, Mahotra NB. Comparison of Central Obesity with Overall Obesity in Predicting the Risk of Type 2 Diabetes Mellitus. *J Univ Coll Med Sci* [Internet]. 2019 Jun. 30;7(1):17-21.
- [28] Zhang S, Huang YP, Li J, Wang WH, Zhang MY, Wang XC, Lin JN, Li CJ. The Visceral-Fat-Area-to-Hip-Circumference Ratio as a Predictor for Insulin Resistance in a Chinese Population with Type 2 Diabetes. *Obes Facts*. 2022;15(4):621-628. doi: 10.1159/000525545. Epub 2022 Jun 20. PMID: 35724630; PMCID: PMC9421683.
- [29] Jin X, Liu J, Cao Q, Lin J, Wu G, Liu L, Jiang S, Zhou X, Li Z, Yang A. Normal-weight central obesity: implications for diabetes mellitus. *Front Nutr*. 2023 Sep 22;10:1239493. doi: 10.3389/fnut.2023.1239493. PMID: 37810923; PMCID: PMC10556475.