

# Correlation Between Two-Hour Glucose Level and Blood Pressure in Nigerian Pregnant Women Attending Antenatal Metabolic Clinic in Jos University Teaching Hospital (JUTH)

**Affi Ayuba**

Dept of Chemical Pathology University of Jos (Corresponding Author) ORCID 0009-9920-7792,  
ayubaaffi67@gmail.com

**Imoh Lucius**

Dept of Chemical Pathology University of Jos ORCID 000-0002-7368-2650,

**Longwap S.A**

(Snr. Lecturer) Dept of Chemical Pathology University of Jos ORCID 0000-003-4678-3372,

**Alfred Odo**

Dept of Chemical Pathology University of Jos ORCID 0009-00024-6699-9887,

**Solomon Luka Mercy**

Dept of Chemical Pathology University of Jos ORCID 0000-0003-3614-7265,

**Dr. Anzaku A.**

(Snr. Registrar) Dept of Anatomical Pathology Jos University Teaching Hospital, Jos

## Abstract

Hypertension and diabetes mellitus are major global public health concerns that frequently coexist and contribute significantly to cardiovascular morbidity and mortality. Both conditions share common risk factors and often interact through complex metabolic pathways. The aim of this study was to assess the relationship between two-hour oral glucose tolerance and blood pressure parameters among patients attending Jos University Teaching Hospital.

A retrospective design was employed, reviewing hospital records from January 2021 to December 2022. The study population consisted of 171 adult patients who had complete records of systolic blood pressure (SBP), diastolic blood pressure (DBP), and two-hour OGTT results. Data were extracted using a structured checklist and analyzed with SPSS version 25. Descriptive statistics summarized baseline values, while Pearson correlation assessed relationships between OGTT results and blood pressure parameters. Chi-square analysis evaluated associations between glucose status and blood pressure categories.

The results showed that the mean systolic and diastolic blood pressure were 117.85 mmHg and 67.73 mmHg in 2021, and 111.80 mmHg and 69.50 mmHg in 2022, respectively. The overall mean two-hour glucose level was 6.57 mmol/L across both years. Correlation analysis indicated a weak, non-significant negative association between two-hour glucose and systolic BP ( $r = -0.044$ ,  $p = 0.568$ ) as well as diastolic BP ( $r = -0.104$ ,  $p = 0.175$ ). A strong positive correlation was observed between systolic and diastolic BP ( $r = 0.609$ ,  $p < 0.001$ ). Chi-square

results showed no significant association between glucose status and blood pressure categories ( $\chi^2 = -0.19$ ,  $p = 0.80$ ).

In conclusion, this study found no significant relationship between two-hour oral glucose tolerance and blood pressure parameters among patients in JUTH, although a strong positive correlation existed between systolic and diastolic pressures. These findings suggest that postprandial glucose regulation may not directly predict blood pressure in this population, underscoring the need for larger, prospective studies to better understand cardiometabolic interactions in Nigerian settings.

**Keywords:** Two-Hour Oral Glucose Tolerance, Diabetes, BP, Blood pressure, Jos, University teaching Hospital, Assessment

## Introduction

Hypertension and diabetes mellitus are among the most significant non-communicable diseases affecting global health, both in terms of prevalence and contribution to morbidity and mortality. The World Health Organization reports that hypertension affects more than 1.3 billion adults worldwide and is a leading cause of premature death [1]. Nearly half of adults with hypertension remain undiagnosed or inadequately controlled, which increases their risk of cardiovascular complications such as stroke, heart failure, and chronic kidney disease [1]. In parallel, diabetes mellitus, particularly type 2 diabetes, is rapidly increasing in prevalence, with the International Diabetes Federation projecting that global cases will reach 643 million by 2030 and 783 million by 2045 [2]. Both diseases share overlapping risk factors, including obesity, sedentary lifestyles, aging, and unhealthy dietary habits, which make them frequent comorbidities in the same patient population [3]. The coexistence of hypertension and diabetes significantly increases the risk of adverse health outcomes, making their combined study particularly important.

One of the most widely used diagnostic tools for assessing glucose metabolism is the oral glucose tolerance test (OGTT), which measures plasma glucose response following ingestion of 75 grams of glucose [4]. The two-hour glucose measurement in OGTT is especially valuable for identifying impaired glucose tolerance (IGT), a pre-diabetic state characterized by elevated postprandial glucose levels but not meeting the

criteria for diabetes diagnosis. Impaired glucose tolerance has been recognized as a strong predictor of progression to diabetes as well as cardiovascular disease [5]. Beyond its diagnostic role, postprandial hyperglycemia has been implicated in endothelial dysfunction, oxidative stress, and vascular remodeling, all of which can contribute to blood pressure elevation [6]. This pathophysiological interplay provides a strong basis for investigating the association between postprandial glucose regulation and blood pressure parameters.

The relationship between glucose metabolism and hypertension has been extensively studied but remains complex and sometimes inconsistent across populations. Tomiyama et al. [7] reported a close relationship between abnormal glucose tolerance and hypertension in a Japanese population, highlighting the clustering of metabolic abnormalities in individuals with cardiovascular risk factors. Similarly, Sattar et al. [8] found that impaired glucose tolerance was associated with significantly higher systolic and diastolic blood pressure values in South Asian cohorts, where metabolic syndrome is highly prevalent. On the other hand, studies in other regions have reported weaker associations. Liu et al. [9], in a rural Chinese cohort, observed that fasting glucose levels, rather than postprandial glucose, were more strongly associated with new-onset hypertension, suggesting that the predictive power of glucose indices may vary depending on demographic and clinical factors.

Ethnic and regional variations play an important role in shaping the observed relationship between glucose tolerance and blood pressure. Zhang et al. [10] in a nationwide Chinese study reported that poor glycemic control was significantly associated with hypertension risk, reinforcing the role of glucose dysregulation in blood pressure elevation. Conversely, Nguyen-Huynh et al. [11] highlighted that in African American populations, lifestyle interventions such as dietary modification and exercise exerted stronger effects on blood pressure than glucose control alone, suggesting that environmental and lifestyle factors may mediate the strength of association between these conditions.

In Nigeria, the double burden of hypertension and diabetes is a growing concern. Recent systematic reviews indicate that the prevalence of hypertension in Nigeria ranges between 28% and 38%, while diabetes prevalence is estimated at 5% to 10%, with higher rates observed in urban settings [12]. Both conditions are often underdiagnosed due to limited access to routine screening, inadequate healthcare infrastructure, and poor health-seeking behavior. Consequently, many patients present late, often with complications such as stroke, kidney disease, or retinopathy [13]. Furthermore, despite the high burden, there is limited local data exploring the relationship between postprandial glucose regulation and blood pressure. Most Nigerian studies have focused separately on the epidemiology of hypertension or diabetes without assessing their interrelationship using OGTT as a diagnostic tool.

## Materials And Methods

### Study Area

This study was carried out at the Jos University Teaching Hospital (JUTH), located in Jos, the capital of Plateau State, Nigeria. Jos lies in the North-Central region of Nigeria and serves as one of the major referral centers for tertiary healthcare in the country. The geographical coordinates of Jos are latitude 9°55'N and longitude 8°54'E. The temperate climate of Jos, with relatively low humidity compared to

surrounding regions, has been suggested to influence disease epidemiology, particularly non-communicable diseases such as diabetes and hypertension.

### Study Design

This research employed a retrospective study design, reviewing hospital records from the period January 2021 to December 2022. A retrospective approach was chosen to allow the analysis of existing patient data on systolic and diastolic blood pressure, as well as two-hour oral glucose tolerance test (OGTT) results, in order to examine possible associations between blood pressure profiles and glycemic control within the study population.

### Study Population

The study population comprised adult patients who attended the Jos University Teaching Hospital during the study period and underwent both blood pressure measurement and oral glucose tolerance testing. Patients with complete records of systolic blood pressure, diastolic blood pressure, and two-hour post-glucose load measurements were included. Exclusion criteria were patients with incomplete records, those diagnosed with gestational diabetes, and those with other metabolic or cardiovascular conditions that could confound glucose and blood pressure outcomes.

### Data Collection

Data were extracted from hospital archives and patient records, particularly from the medical outpatient department and endocrinology clinic. A structured data extraction sheet was used to capture relevant variables, including age, sex, systolic blood pressure, diastolic blood pressure, and two-hour oral glucose tolerance values. Only anonymized data were collected to ensure patient confidentiality and compliance with ethical standards.

### Data Analysis

The extracted data were coded and entered into the Statistical Package for the Social Sciences (SPSS, version 25.0; IBM Corp., Armonk, NY, USA) for analysis. Descriptive statistics,

including mean and standard deviation, were used to summarize continuous variables such as blood pressure and glucose values. Independent sample t-tests were employed to compare mean systolic blood pressure, diastolic blood pressure,

and two-hour glucose levels between 2021 and 2022. Statistical significance was set at  $p < 0.05$ . Results were presented in tables and graphs to highlight trends and differences between the two study years.

## Results

Table 1: Prevalence of Two-Hour Glucose Level in Nigerian Pregnant Women Attending Antenatal Metabolic Clinic in Jos University Teaching Hospital (JUTH)

| 2-Hour Oral Glucose | Percent   |
|---------------------|-----------|
| 1-10                | 162(94.7) |
| $\geq 11$           | 9(5.3)    |
| Total               | 171(100)  |

Table 2: Mean Systolic and Diastolic Blood Pressure and 2 hr Oral Glucose for 2021 and 2022

| Year  | Mean Systolic BP | Mean Diastolic BP | 2 Hour Oral Glucose |
|-------|------------------|-------------------|---------------------|
| 2021  | 117.85           | 67.73             | 6.50                |
| 2022  | 111.80           | 69.50             | 6.60                |
| Total | 113.99           | 68.86             | 6.57                |

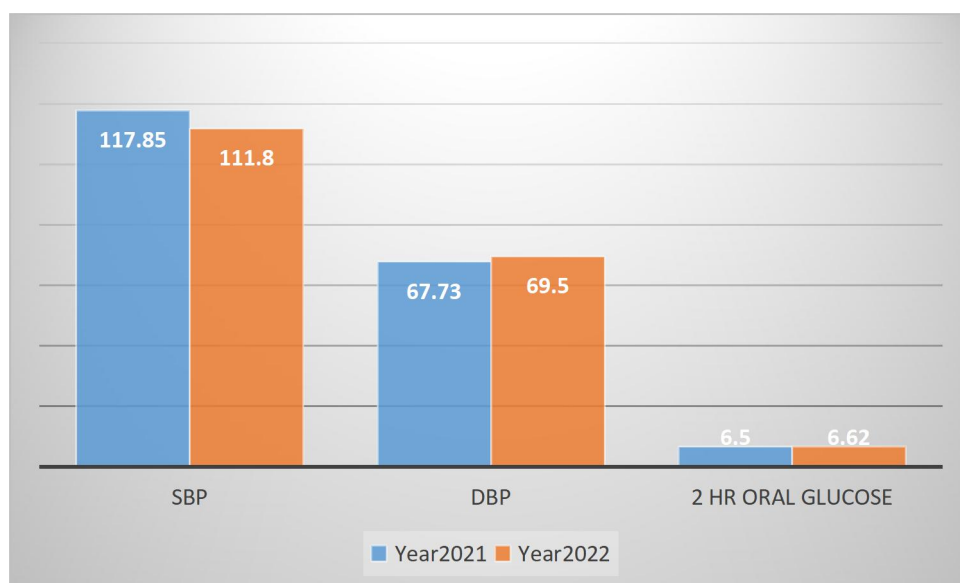


Figure 1: Mean systolic and diastolic blood pressure and 2 hr oral glucose

Table 3: Correlation Between 2-Hour Glucose Level and Blood Pressure Parameters

| Variables                       | N   | Pearson Correlation (r) | p-value |
|---------------------------------|-----|-------------------------|---------|
| 2-Hour Glucose vs. Systolic BP  | 171 | -0.044                  | 0.568   |
| 2-Hour Glucose vs. Diastolic BP | 171 | -0.104                  | 0.175   |
| Systolic BP vs. Diastolic BP    | 171 | 0.609                   | 0.000   |

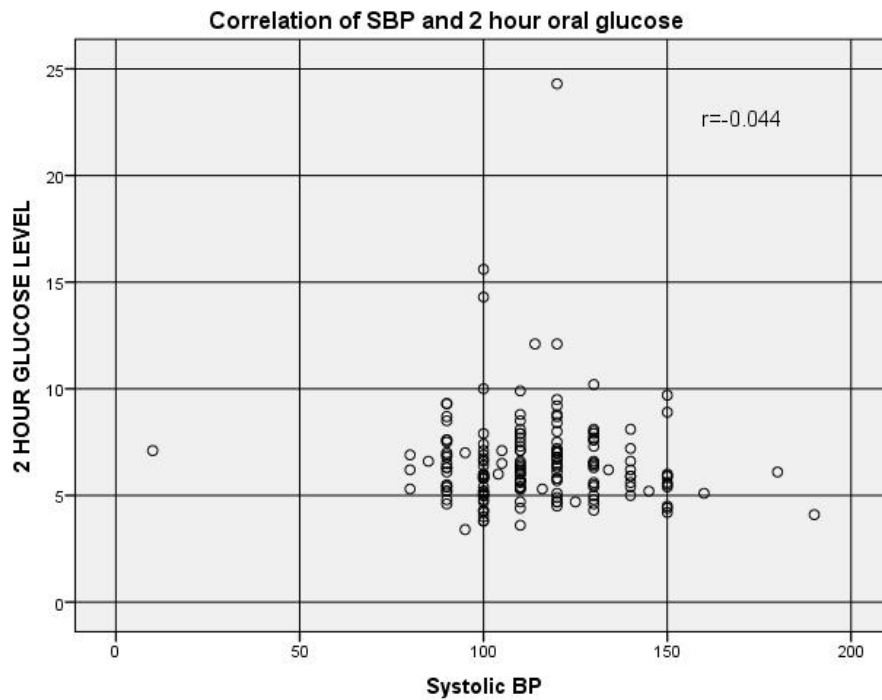


Figure 2: Correlation of SBP and 2hr oral glucose

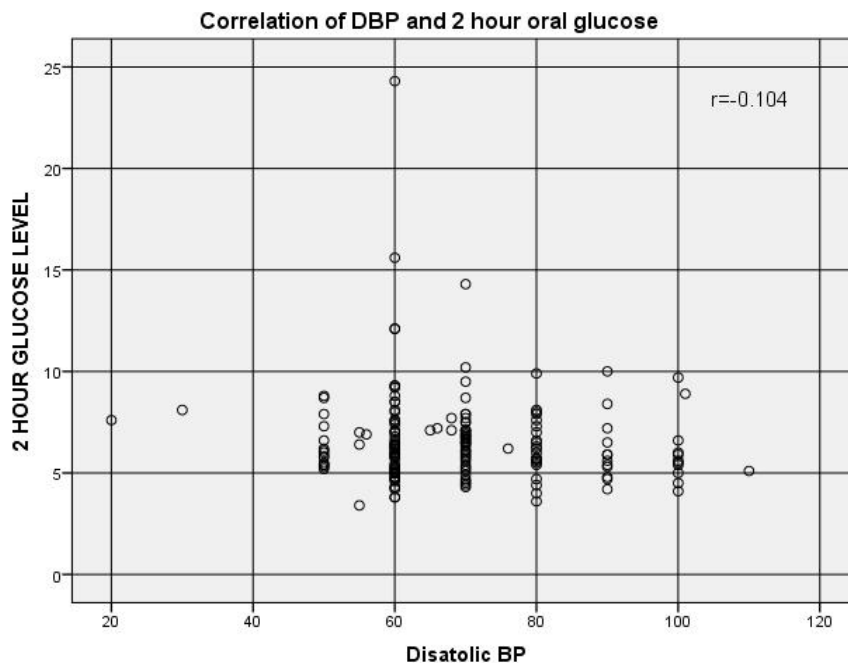


Figure 3: Correlation of DBP and 2hr oral glucose

Table 4: Relationship Between 2 Hours Glucose and Blood Pressure

| 2 Hrs Oral<br>Glucose | No. examined | Normal   | Elevated | Blood Pressure       |                      |                     |
|-----------------------|--------------|----------|----------|----------------------|----------------------|---------------------|
|                       |              |          |          | Hypertension stage 1 | Hypertension stage 2 | Hypertensive crisis |
| Normal                | 117          | 65(55.5) | 14(12.0) | 15(12.8)             | 22(18.8)             | 1(0.9)              |
| Diabetic              | 54           | 27(50.0) | 12(22.2) | 8(14.8)              | 6(11.1)              | 1(1.9)              |

( $\chi^2=-0.19$ , p-value=0.80)

## Discussion

This study assessed the relationship between two-hour oral glucose tolerance (2-hr OGTT) and blood pressure parameters at Jos University Teaching Hospital. Majority of pregnant women attending the antenatal metabolic clinic at Jos University Teaching Hospital (JUTH) had normal 2-hour oral glucose values within the range of 1–10 mmol/L, accounting for 94.7% of the study population. Only 5.3% recorded glucose values  $\geq 11$  mmol/L, indicating hyperglycemia suggestive of gestational diabetes mellitus (GDM). This finding suggests that while most of the women maintained normal glucose tolerance, a small but important proportion exhibited abnormal levels, highlighting the presence of glucose intolerance in pregnancy. The observed prevalence (5.3%) aligns with global estimates of GDM, which typically range from 3–10%, though prevalence can vary depending on ethnicity, diagnostic criteria, and screening practices [1].

The mean systolic blood pressure (SBP) declined from 117.85 mmHg in 2021 to 111.80 mmHg in 2022, while the mean diastolic blood pressure (DBP) slightly increased from 67.73 mmHg to 69.50 mmHg. Interestingly, the mean 2-hr glucose levels remained relatively stable between the two years, changing only marginally from 6.50 mmol/L in 2021 to 6.60 mmol/L in 2022. When the pooled mean values were considered, the SBP averaged 113.99 mmHg, DBP 68.86 mmHg, and 2-hr glucose 6.57 mmol/L. These values reflect a largely normotensive population with normal glucose tolerance overall.

The observed decline in SBP across the years aligns with reports by Nguyen et al. [2] who demonstrated that better awareness of

cardiovascular risk factors and improved clinical follow-up in hospital settings could contribute to reduced SBP among patients over time. Conversely, the slight rise in DBP contrasts with findings by Ferguson et al. [3], who reported a parallel reduction in both SBP and DBP among adults with improved glycemic control. This difference may be attributable to population variations, as diastolic pressure often rises in younger adults before declining with age, suggesting that the 2022 cohort may have included more individuals in a younger or mid-aged bracket.

The correlation analysis provides further depth to the relationship between glucose tolerance and blood pressure. The Pearson correlation between 2-hr glucose and SBP was weakly negative ( $r = -0.044$ ,  $p = 0.568$ ), while that between 2-hr glucose and DBP was also negative but slightly stronger ( $r = -0.104$ ,  $p = 0.175$ ). These weak and statistically insignificant associations suggest that in this population, short-term postprandial glucose levels may not exert a strong influence on blood pressure. This finding is consistent with the work of Huang et al. [4], who found that the correlation between 2-hr glucose and blood pressure was modest and often not statistically significant after adjusting for age and body mass index. However, it contrasts with the results of Sattar et al. [5], who demonstrated that impaired glucose tolerance was significantly associated with higher SBP and DBP in South Asian populations. The variation could be due to ethnic and lifestyle differences, as African populations have shown distinct cardiometabolic profiles compared with Asian and European cohorts.

The strongest correlation observed in this study was between SBP and DBP ( $r = 0.609$ ,  $p <$

0.001), indicating a moderate-to-strong positive relationship. This is not surprising since systolic and diastolic pressures are physiologically interrelated and tend to rise together. This agrees with the findings of Whelton et al. [6] in the American Heart Association (AHA) guidelines, which highlighted the close linear relationship between systolic and diastolic blood pressures in the progression of hypertension.

The relationship between glucose tolerance status and categories of blood pressure further highlights the interplay between these parameters. Among participants with normal 2-hr glucose, 55.5% had normal blood pressure, 12.0% had elevated blood pressure, 12.8% had stage 1 hypertension, 18.8% had stage 2 hypertension, and 0.9% were in hypertensive crisis. Similarly, among those with diabetic-range 2-hr glucose values, 50.0% were normotensive, while higher proportions experienced elevated blood pressure (22.2%) and hypertensive crisis (1.9%). Despite these differences, the chi-square test showed no statistically significant association ( $\chi^2 = -0.19$ ,  $p = 0.80$ ), indicating that abnormal glucose tolerance was not independently predictive of hypertension in this study population.

This lack of significant association contrasts with the well-documented clustering of impaired glucose tolerance and hypertension in metabolic syndrome, as described by Grundy et al. [7]. Several studies, including those by Cheung et al. [8] and Wu et al. [9], reported that individuals with abnormal glucose tolerance were more likely to present with elevated blood pressure, particularly in urban populations with sedentary lifestyles and higher obesity prevalence. The divergence in findings may be due to sample characteristics in this study, as the majority of participants still maintained normal or near-normal glucose levels, thereby reducing the statistical power to detect significant associations.

Furthermore, while diabetes and hypertension are frequently comorbid, some studies suggest that the relationship is stronger when fasting

glucose or HbA1c is used as the marker of glycemic status rather than the 2-hr OGTT. For instance, Katsuki et al. [10] found that fasting hyperglycemia showed a more robust association with hypertension than postprandial glucose, suggesting that different glycemic indices capture distinct pathophysiological processes. This could partly explain why no significant associations were found in the present study despite observable trends toward higher blood pressure categories among diabetic participants.

### Conclusion

This study assessed the relationship between two-hour oral glucose tolerance and blood pressure parameters among patients at Jos University Teaching Hospital. The findings revealed that mean systolic blood pressure decreased slightly between 2021 and 2022, while diastolic pressure showed a modest increase, with mean two-hour glucose values remaining relatively stable across the two years. Correlation analysis demonstrated weak, non-significant associations between two-hour glucose levels and both systolic and diastolic blood pressures, while systolic and diastolic pressures were moderately and significantly correlated with each other. Furthermore, although a greater proportion of participants with diabetic-range glucose values had elevated blood pressure and hypertensive crisis compared to those with normal glucose tolerance, this relationship was not statistically significant.

### References

1. World Health Organization. Hypertension. Geneva: WHO; 2021.
2. International Diabetes Federation. IDF Diabetes Atlas. 10th ed. Brussels: IDF; 2021.
3. Grundy SM, Cleeman JI, Daniels SR, Donato KA, Eckel RH, Franklin BA, et al. Diagnosis and management of the metabolic syndrome: an American Heart Association/National Heart, Lung, and Blood Institute scientific statement. *Circulation*. 2005;112(17):2735–52.

4. American Diabetes Association. Classification and diagnosis of diabetes: Standards of medical care in diabetes—2022. *Diabetes Care*. 2022;45(Suppl 1):S17–38.
5. Tabák AG, Jokela M, Akbaraly TN, Brunner EJ, Kivimäki M, Witte DR. Trajectories of glycaemia, insulin sensitivity, and insulin secretion before diagnosis of type 2 diabetes: an analysis from the Whitehall II study. *Lancet*. 2009;373(9682):2215–21.
6. Katsuki A, Sumida Y, Murashima S, Murata K, Takarada Y, Ito K, et al. Acute hyperglycemia impairs endothelium-dependent vasodilation in humans. *Diabet Med*. 1999;16(7):554–8.
7. Tomiyama H, Hashimoto H, Hirayama Y, Yambe M, Yamada J, Koji Y, et al. Synergistic relationship between hypertension and impaired glucose tolerance for atherosclerosis in Japanese men. *Hypertension*. 2000;35(2):475–9.
8. Sattar N, Gill JMR, Alazawi W. Improving prevention strategies for cardiometabolic disease. *Nat Med*. 2020;26(3):320–5.
9. Liu Y, Li H, Chen S, Wang W, Li Z, Chen G, et al. Fasting glucose and new-onset hypertension: a prospective cohort study in Chinese adults. *J Hypertens*. 2021;39(5):991–9.
10. Zhang X, Zhao Y, Zhang M, Li C, Wang Y, Wang Y, et al. Glycemic control and risk of hypertension: findings from a nationwide Chinese cohort. *Diabetes Res Clin Pract*. 2024;207:110–26.
11. Nguyen-Huynh MN, Lee J, Choi J, Liao D, Reis JP, Carnethon MR, et al. Lifestyle modification and blood pressure control among African American adults: results from a community-based study. *J Am Heart Assoc*. 2022;11(5):e024983.
12. Adeloye D, Ige JO, Aderemi AV, Adeleye N, Amoo EO, Auta A, et al. Estimating the prevalence, hospitalisation and mortality from hypertension in Nigeria: a systematic review and meta-analysis. *BMJ Open*. 2019;9(5):e029514.
13. Ogah OS, Okpechi I, Chukwuonye II, Akinyemi JO, Onwubere BJC, Falase AO, et al. Blood pressure, prevalence of hypertension and hypertension-related complications in Nigerian Africans: a review. *World J Cardiol*. 2012;4(12):327–40.