

Socioeconomic, Lifestyle, and Dietary Factors Associated with Concurrent Hypertension and Diabetes among Adults in Selected Communities in Southwestern Nigeria: A Cross- Sectional Study

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Abstract

Background

Hypertension and diabetes frequently coexist, increasing cardiometabolic morbidity and mortality. Evidence on the coexistence of these conditions and their socioeconomic, lifestyle, and dietary correlates in Southwestern Nigeria remains limited. This study aimed to assess the burden of concurrent hypertension and diabetes and determine the socioeconomic, lifestyle, and dietary factors associated with their coexistence among adults in selected communities in Southwestern Nigeria.

Methods

A community-based cross-sectional study was conducted among adults in selected urban and peri-urban communities in Southwestern Nigeria between July and December 2025. Using a two-stage probability-sampling approach, 500 adults were screened for hypertension and diabetes. All 244 participants who screened positive for at least one condition underwent detailed sociodemographic, lifestyle, anthropometric, and dietary assessment. Dietary patterns were derived using principal component analysis. Associations with concurrent hypertension-diabetes screening positivity were evaluated using Firth bias-reduced logistic regression adjusted for age, sex, and body mass index, with Benjamini-Hochberg false-discovery-rate correction across 11 exposure tests.

Results

Among the 244 screen-positive participants, 14.8% had both conditions. Three dietary patterns, plant-rich traditional, beverage-animal foods, and grain-condiment/snack, explained 39.0% of dietary variation. Higher monthly income showed the strongest adjusted association with concurrent screening positivity (aOR per income-category increase 1.45, 95% CI 1.05–1.98; $p = 0.023$), but this association did not remain statistically significant after false-discovery-rate correction ($q = 0.251$). No measured lifestyle or dietary-pattern exposure remained significant after correction. Sensitivity analyses using more specific outcome definitions showed a similar positive income gradient.

Conclusion

Concurrent hypertension and diabetes represents a meaningful cardiometabolic burden among adults in these Southwestern Nigerian communities. Although higher income showed a consistent positive association across analyses, the finding remains exploratory because it did not withstand multiple-testing correction. Integrated screening and larger prospective studies using confirmatory measurements are warranted.

Introduction

Hypertension and diabetes mellitus are major noncommunicable diseases that frequently occur together. Their coexistence is clinically important because it increases the risks of cardiovascular disease, kidney disease, retinopathy, and premature death beyond the risk associated with either condition alone [1, 2]. This combined burden is especially important in sub-Saharan Africa, where chronic disease is increasing while many health systems continue to face challenges with early detection, long-term follow-up, and access to treatment [2]. Both conditions are common in Nigeria. A 2026 systematic review estimated a pooled hypertension prevalence of 34.2% among Nigerian adults, with an estimate of 41.7% in the South-West, although prevalence varied substantially across studies [3]. A 2024 systematic review likewise showed that type 2 diabetes is an important and geographically variable public-health problem in Nigeria [4]. The financial consequences are also considerable because the direct and indirect costs of long-term treatment can place substantial pressure on households [5].

Diet and lifestyle may contribute to both conditions. West African evidence has linked high intakes of salt, fat, red meat, processed foods, and alcohol with adverse blood-pressure profiles, while fruit and vegetable intake may be beneficial [6]. Nigerian community studies have also described low physical activity and inadequate fruit and vegetable intake [7]. Because foods are eaten in combinations, dietary-pattern analysis can provide information that is not captured by examining individual food groups alone. A semi-quantitative food-frequency questionnaire developed for South-West Nigeria has demonstrated reasonable validity for ranking several foods and nutrients [8]. Socioeconomic circumstances may influence cardiometabolic health through several pathways. Higher income may improve access to healthcare and diagnosis, but it may also accompany sedentary work and energy-dense diets. Lower income may limit access to healthy foods, preventive services, and continuing care. Nigerian studies have therefore reported different relationships between socioeconomic status and hypertension or diabetes across populations [5, 9]. In addition, evidence on the coexistence of hypertension and diabetes in community populations remains limited. One Nigerian community study reported concurrent hypertension and diabetes in 6.7% of participants [10]. The objective of this study is to assess the burden of concurrent hypertension and diabetes and determine the socioeconomic, lifestyle, and dietary factors associated with their coexistence among adults in selected communities in Southwestern Nigeria.

Methods

Study design, setting, and period

This community-based cross-sectional study was conducted in selected urban and peri-urban communities in Osun State, Southwestern Nigeria, between July and December 2025. The study had two sequential phases. First, randomly selected community adults underwent screening for hypertension and diabetes. Second, adults who screened positive for at least one of the two conditions completed the detailed questionnaire, anthropometric assessment, and dietary assessment used for the association

analyses. Disease status was therefore determined after random selection and was not used to choose adults for the initial community screening.

Study population and eligibility

Adults aged 18 years or older who had lived in the study area for at least six months were eligible for the initial community screening. Selection for screening was independent of previous hypertension or diabetes status. Before screening, eligibility and consent were confirmed. For the detailed analytic study, participants had to meet the screening criterion for hypertension and/or diabetes and be able to complete the questionnaire and study measurements. Pregnant individuals, critically ill individuals, and people receiving medically prescribed therapeutic diets were excluded because these circumstances could materially affect anthropometric or dietary measurements.

Study size

The minimum number of adults required for the community screening was estimated using Cochran's single-population proportion formula, $n = Z^2 p(1-p)/d^2$ [11]. A Nigerian community study reported a 6.7% prevalence of concurrent hypertension and diabetes [10], so $p = 0.067$ was used. With $Z = 1.96$ for a 95% confidence level and 5% absolute precision ($d = 0.05$), the initial sample-size estimate was 96.1. To allow for clustering from the two-stage sampling design, a design effect of 2.0 was applied, giving 192.1 participants. Allowing 10% for nonresponse using $n/(1-0.10)$ produced a minimum screening sample of 213.5, rounded up to 214. However, 500 adults were ultimately screened to ensure adequate identification of individuals meeting the study eligibility criteria. All adults who screened positive for hypertension and/or diabetes were retained for the detailed study; the association analyses were considered exploratory because the number with concurrent screening positivity was limited.

Sampling design and participant selection

A two-stage probability-sampling design was used [12]. In the first stage, a sampling frame of eligible urban and peri-urban communities in the study area was prepared from available administrative and community listings. Each community was assigned a unique identification number, and study communities were selected by simple random sampling without replacement using a random-number procedure. Community selection was completed before any individual participant was screened.

In the second stage, a community-specific adult sampling frame was constructed in each selected community through household listing and enumeration of resident adults who met the age and residency criteria. Each eligible adult was assigned a unique sampling number. The screening target for each community was set before individual selection, with larger adult sampling frames contributing more participants. Within each community, adults were then selected by simple random sampling without

replacement from the completed adult frame until the prespecified community screening target was reached.

Selected adults were contacted through their listed households or usual place of residence and invited to the screening visit. The research team confirmed age and residency eligibility, explained the study, and obtained informed consent before any screening measurement. Disease status was not known when adults were selected. Adults who were not selected from the sampling frame were not enrolled as volunteers. If an additional participant was required to complete a community's prespecified target, that person was drawn from the same community sampling frame using the same random procedure.

Overall, 500 randomly selected adults completed hypertension and diabetes screening. Of these, 256 did not meet either screening criterion and did not proceed to the detailed analytic phase. The remaining 244 adults met the screening criterion for hypertension and/or diabetes and constituted the analytic study population. All 244 screen-positive adults were included in the main analysis. The archived analytic dataset contains the detailed data for these 244 participants; community-level frame sizes and complete contact/nonresponse logs were not retained in the analysis file.

Study variables

The primary descriptive outcome for the community screening phase was concurrent hypertension-diabetes screening positivity among all 500 adults screened. For the detailed analytic phase, the primary binary outcome was concurrent screening positivity for both hypertension and diabetes among the 244 adults who had screened positive for at least one condition. The exposures of interest were monthly income, smoking, household exposure to a smoker, current alcohol or alcohol-containing herbal-mixture use, physical-activity frequency, meal skipping, adding salt at the table, checking nutrition labels, and dietary-pattern scores. Age, sex, and body mass index (BMI) were treated as prespecified confounders.

Data collection and measurements

Trained research assistants fluent in English and Yoruba administered a structured interviewer-administered questionnaire in the participant's preferred language. Initial screening captured the information and measurements required to determine hypertension and diabetes screening status. Adults who screened positive for at least one condition then completed the detailed assessment, which included sociodemographic information, previous medical diagnoses, medication history, tobacco and alcohol exposure, physical activity, meal patterns, table-salt use, nutrition-label checking, anthropometry, and food-consumption frequency. The same measurement and interview procedures were used across the selected communities.

Blood pressure was measured with an automated sphygmomanometer after at least five minutes of seated rest. An initial blood-pressure value was available for all participants in the analytic dataset. A systolic blood pressure of at least 140 mmHg and/or a diastolic blood pressure of at least 90 mmHg

was treated as a positive screening value [13]. Random capillary blood glucose was measured by finger-prick using a portable glucometer and recorded in mmol/L. A random glucose value of at least 11.1 mmol/L was treated as a positive diabetes screening value [14]. As with blood pressure, this threshold was used for screening and eligibility rather than as a substitute for confirmatory clinical diagnosis. Height and weight were measured using standard field procedures, and BMI was calculated as weight in kilograms divided by height in metres squared. During data validation, two recorded adult heights below 120 cm generated implausible BMI values; these two BMI values were treated as missing in BMI-adjusted analyses and were not replaced by assumed values.

Operational outcome definitions

For study screening, hypertension positivity was defined as either a previous clinical diagnosis of hypertension or a study systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg. Diabetes positivity was defined as either a previous clinical diagnosis of diabetes or random capillary glucose ≥ 11.1 mmol/L. Participants were classified into three mutually exclusive screening groups: hypertension only, diabetes only, or concurrent hypertension and diabetes. Only participants in the latter three groups proceeded to the detailed analytic phase. The primary association outcome was concurrent hypertension and diabetes versus only one of the two screening-positive conditions.

Two more specific outcome definitions were used in sensitivity analyses. First, among participants without a previous diabetes diagnosis, random glucose ≥ 11.1 mmol/L was required together with frequent urination before classifying diabetes positivity; this reduced the concurrent outcome to 28 participants. Second, a diagnosis-only definition required a previous clinical diagnosis of both hypertension and diabetes and did not use the study screening measurements; 16 participants met this definition. These analyses assessed whether the main findings were sensitive to the broad screening definition.

Dietary assessment and dietary-pattern analysis

Diet was assessed using a semi-quantitative food-frequency questionnaire adapted from a validated instrument for South-West Nigerian diets [8]. Participants reported the frequency of consuming each food group during the previous week as never, 1–3 times per week, 4–6 times per week, or daily. The archived dataset contained leafy vegetables, fats/oils, fruits, fish, meat, poultry, grains, maize, legumes, tubers, dairy products, snacks, sugary drinks, alcohol, and condiments.

During data validation, fish and meat had exactly the same archived responses for all participants. Because the available data could not distinguish the two variables, a single shared fish/meat variable was retained for principal component analysis (PCA) to avoid counting identical information twice. PCA was performed on 14 standardized food-frequency variables. Sampling adequacy and factorability were assessed with the Kaiser-Meyer-Olkin statistic and Bartlett's test of sphericity. The number of

components was selected using 500-replicate parallel analysis together with the observed eigenvalue pattern [15]. Components were rotated with varimax rotation, and standardized individual pattern scores were calculated; higher scores indicated stronger adherence to the corresponding pattern.

Data quality, missing data, and bias reduction

Before analysis, the dataset underwent range, logic, consistency, and duplicate-record checks. No exact duplicate participant records were identified. Repeated participant identifiers were investigated; the corresponding records differed on multiple demographic and clinical variables and were therefore not automatically treated as duplicate observations. A sensitivity analysis excluding records with repeated identifiers was performed. Missing values were not imputed. Several steps were used to reduce selection and measurement bias. The screening criteria were applied only after an adult had been randomly selected, and all adults who met at least one screening criterion were retained for the detailed study. The same questionnaire and measurement protocol was used across communities, and interviews were conducted in the participant's preferred language. Because the study was cross-sectional and used single-visit screening measurements, all disease-related findings are described as screening positivity or associations rather than as incident disease or causal effects.

Statistical analysis

For the community screening phase, frequencies and percentages were used to summarize the 500 adults by screening outcome, and Wilson 95% confidence intervals were calculated for the proportion screening positive for both hypertension and diabetes. For the 244 screen-positive adults in the detailed study, continuous variables were summarized with means and standard deviations and categorical variables with frequencies and percentages. Because only 36 participants met the primary concurrent screening outcome, conventional maximum-likelihood logistic regression could be unstable. Associations were therefore estimated using Firth bias-reduced logistic regression, with odds ratios (ORs) and profile-likelihood 95% confidence intervals [16, 17].

Each exposure was first examined in an unadjusted model and then in a separate parsimonious model adjusted for age, sex, and BMI. A single model containing all candidate exposures was avoided because of the limited number of concurrent outcome events. Age was entered per 10-year increase and BMI per 5-kg/m² increase. Monthly income was analyzed as an ordered four-level variable (<N50,000; N50,000-100,000; N100,000-200,000; >N200,000). Regular physical activity was defined analytically as reporting activity often or always; the questionnaire did not capture sufficient duration and intensity to determine whether guideline targets were met.

Eleven exposure tests were evaluated: income, household smoker exposure, ever smoking, current alcohol/alcohol-containing herbal-mixture use, regular physical activity, meal skipping, table-salt use, nutrition-label checking, and the three dietary-pattern scores. The Benjamini-Hochberg false-discovery-rate procedure was applied to the 11 adjusted exposure p values [18]. Sensitivity analyses repeated the income model using the more specific symptomatic-glucose outcome, the diagnosis-only outcome, and

a dataset excluding records with repeated participant identifiers. All tests were two-sided. Because community identifiers and selection probabilities were not retained in the final analytic dataset, the screening proportions are reported as crude unweighted estimates and regression standard errors could not be corrected for community clustering; this is addressed in the limitations. Data management and descriptive analyses were performed in IBM SPSS Statistics version 26, and Firth regression was reproduced using numerical implementation of penalized likelihood.

Ethical considerations

Ethical approval

was obtained from the Osun State Health Research Ethics Committee, Ministry of Health (OSHREC/PRS/569T/1102; approved 4 August 2025, valid through 4 August 2026). Permission to conduct community screening and the detailed study was obtained from relevant community authorities and local leaders. Verbal informed consent was obtained before screening under the approved study procedures because participants had varying literacy levels. Participation was voluntary, no monetary incentive was provided, and confidentiality and anonymity were maintained.

Results

Participant flow and characteristics

A total of 500 randomly selected adults completed community screening. Of these, 256 (51.2%) did not meet the screening criterion for either hypertension or diabetes. The remaining 244 (48.8%; 95% CI 44.4%-53.2%) screened positive for at least one condition and entered the detailed analytic study. Within the full screening sample, 196 (39.2%) screened positive for hypertension only, 12 (2.4%) for diabetes only, and 36 (7.2%; 95% CI 5.2%-9.8%) for both hypertension and diabetes. Thus, every adult in the 244-person analytic cohort was screen-positive for at least one condition by design; the study did not recruit only people already known to have hypertension or diabetes.

Among the 244 screen-positive adults, the mean age was 55.48 years (SD 14.55), and 192 (78.7%) were women. More than half were aged 56 years or older, and 145 (59.4%) reported monthly income below ₦50,000. Mean initial systolic and diastolic blood pressures were 148.07 mmHg (SD 22.72) and 84.37 mmHg (SD 14.60), respectively. Mean random glucose was 6.35 mmol/L (SD 3.51); mean BMI among 242 participants was 27.63 kg/m² (SD 6.27).

Screening classification and previous diagnoses

Among the 244 adults who entered the detailed study, 196 (80.3%) were positive for hypertension only, 12 (4.9%) were positive for diabetes only, and 36 (14.8%) were positive for both conditions. A previous clinical diagnosis of hypertension was recorded for 113 participants (46.3%), a previous diagnosis of diabetes for 32 (13.1%), and a previous diagnosis of both conditions for 16 (6.6%). The community-screening prevalence of concurrent hypertension-diabetes positivity was therefore 36/500 (7.2%; 95% CI

5.2%-9.8%). Among adults who screened positive for at least one condition, 36/244 (14.8%; 95% CI 10.9%-19.7%) had concurrent screening positivity. These two percentages use different denominators and are reported separately to avoid implying that the 244-person analytic cohort was representative of all community adults.

Lifestyle and dietary characteristics

Current smoking was uncommon (7 participants; 2.9%), while 44 (18.0%) lived in the same compound as a smoker. Current alcohol or alcohol-containing herbal-mixture use was reported by 37 (15.2%). Seventy-two participants (29.5%) reported physical activity often or always. Meal skipping was reported by 128 (52.5%), adding salt at the table by 72 (29.5%), and checking nutrition labels by 66 (27.0%). Full food-frequency results are provided in Table 6.

Table 1
Sociodemographic, clinical, and screening characteristics

Characteristic	Category/statistic	Value
Age group	< 25 years	9 (3.7)
	25–35 years	15 (6.1)
	36–45 years	39 (16.0)
	46–55 years	53 (21.7)
	56–65 years	66 (27.0)
	> 65 years	62 (25.4)
	Mean (SD) = 55.48 (14.55)	
Sex	Male	52 (21.3)
	Female	192 (78.7)
Marital status	Married	173 (70.9)
	Other status	71 (29.1)
Education	No formal education	53 (21.7)
	Primary	65 (26.6)
	Secondary	55 (22.5)
	Tertiary	71 (29.1)
Monthly income	< ₦50,000	145 (59.4)
	₦50,000-100,000	47 (19.3)
	₦100,000-200,000	25 (10.2)
	> ₦200,000	27 (11.1)
Previous clinical diagnosis	Hypertension	113 (46.3)
	Diabetes	32 (13.1)
	Both hypertension and diabetes	16 (6.6)
Screening classification	Hypertension only	196 (80.3)
	Diabetes only	12 (4.9)
	Concurrent hypertension and diabetes	36 (14.8)
Initial systolic BP, mmHg	Mean (SD)	148.07 (22.72)
<i>Values are n (%) unless otherwise stated. BP=blood pressure; BMI=body mass index.</i>		

Characteristic	Category/statistic	Value
Initial diastolic BP, mmHg	Mean (SD)	84.37 (14.60)
Random glucose, mmol/L	Mean (SD)	6.35 (3.51)
BMI, kg/m ²	Mean (SD)	27.63 (6.27)
<i>Values are n (%) unless otherwise stated. BP=blood pressure; BMI=body mass index.</i>		

Table 2
Lifestyle and dietary-practice indicators

Indicator	Category	n (%)
Smoking	Current	7 (2.9)
	Former	47 (19.3)
	Never	190 (77.9)
Smoker in same compound	Yes	44 (18.0)
Alcohol/alcohol-containing herbal mixture	Current	37 (15.2)
	Former	58 (23.8)
	Never	149 (61.1)
Physical activity frequency	Never	60 (24.6)
	Rarely	18 (7.4)
	Sometimes	94 (38.5)
	Often	45 (18.4)
	Always	27 (11.1)
Regular physical activity	Often/always	72 (29.5)
Meals per day	1	2 (0.8)
	2	63 (25.8)
	3	115 (47.1)
	4+	64 (26.2)
Usually skips meals	Yes	128 (52.5)
Adds salt at table	Yes	72 (29.5)
Checks nutrition labels	Yes	66 (27.0)
<i>Regular physical activity was defined analytically as reporting activity often or always on the questionnaire frequency scale.</i>		

Table 3
Varimax-rotated loadings for the three retained dietary patterns

Food group	Plant-rich traditional	Beverage-animal foods	Grain-condiment/snack
Leafy vegetables	0.635		
Fats/oils			0.330
Fruits	0.621		
Fish/meat (shared archived response)	0.472	0.328	
Poultry		0.618	
Grains			0.637
Maize	0.574		
Legumes	0.510		0.418
Tubers	0.393	0.482	
Dairy		0.418	
Snacks		0.355	0.441
Sugary drinks		0.578	0.369
Alcohol		0.569	
Condiments			0.737
<i>Loadings with absolute value < 0.30 are suppressed. KMO = 0.622; Bartlett chi-square = 362.97, df = 91, $p < 0.001$. The three components explained 39.0% of total variance. Fish and meat were perfectly collinear in the archived data; one shared fish/meat signal was retained in PCA to avoid duplicate weighting.</i>			

Table 4

Firth bias-reduced logistic regression for concurrent hypertension-diabetes screening positivity

Exposure	Unadjusted OR (95% CI)	p	Adjusted OR (95% CI)	p	BH q
Monthly income (per category increase)	1.52(1.12–2.07)	0.007*	1.45(1.05–1.98)	0.023*	0.251
Smoker in same compound (yes vs no)	0.42 (0.11–1.18)	0.146	0.44(0.11–1.24)	0.164	0.450
Ever smoker (current/former vs never)	1.04 (0.43–2.31)	0.923	1.06(0.43–2.39)	0.884	0.973
Current alcohol/herbal alcohol use (yes vs no)	1.20 (0.44–2.89)	0.702	1.12(0.37–2.90)	0.821	0.973
Regular physical activity (often/always vs less)	1.44 (0.68–2.97)	0.330	1.36(0.63–2.85)	0.418	0.920
Usually skips meals (yes vs no)	1.96 (0.96–4.20)	0.073	1.79(0.87–3.86)	0.121	0.445
Adds salt at the table (yes vs no)	0.93 (0.41–1.97)	0.852	0.92(0.41–1.96)	0.837	0.973
Checks nutrition labels (yes vs no)	1.07 (0.47–2.27)	0.866	0.85(0.36–1.86)	0.695	0.973
Plant-rich traditional pattern (per SD)	1.04 (0.73–1.48)	0.829	0.99(0.69–1.43)	0.977	0.977
Beverage-animal foods pattern (per SD)	0.89 (0.61–1.27)	0.546	0.90(0.61–1.29)	0.583	0.973
Grain-condiment/snack pattern (per SD)	0.71 (0.49–1.02)	0.070	0.71(0.48–1.03)	0.077	0.422
<i>ORs and 95% CIs are from Firth penalized likelihood; CIs are profile-likelihood intervals. BH q=Benjamini-Hochberg false-discovery-rate adjusted p value.</i>					

Table 5
Sensitivity analyses for the income-concurrent screening outcome association

Analysis	Outcome events	Income trend aOR (95% profile CI)	p
Primary screening outcome	36(14.8%)	1.45 (1.05–1.98)	0.023*
More specific symptomatic-glucose outcome	28(11.5%)	1.69 (1.19–2.40)	0.003*
Diagnosis-only concurrent hypertension and diabetes	16(6.6%)	1.78 (1.15–2.77)	0.009*
Primary outcome after excluding records with repeated participant identifiers	36(15.0%)	1.44 (1.04–1.97)	0.026*
<i>All models used Firth bias-reduced logistic regression and adjusted for age, sex, and BMI.</i>			

Table 6
Food-frequency responses over the preceding week

Food group	Never	1–3 times/week	4–6 times/week	Daily
Leafy vegetables	23 (9.4)	145 (59.4)	37 (15.2)	39 (16.0)
Fats/oils	0 (0.0)	51 (20.9)	27 (11.1)	166 (68.0)
Fruits	43 (17.6)	124 (50.8)	33 (13.5)	44 (18.0)
Fish	29 (11.9)	84 (34.4)	56 (23.0)	75 (30.7)
Meat	29 (11.9)	84 (34.4)	56 (23.0)	75 (30.7)
Poultry	95 (38.9)	112 (45.9)	19 (7.8)	18 (7.4)
Grains	10 (4.1)	96 (39.3)	62 (25.4)	76 (31.1)
Maize	15 (6.1)	70 (28.7)	44 (18.0)	115 (47.1)
Legumes	7 (2.9)	101 (41.4)	68 (27.9)	68 (27.9)
Tubers	56 (23.0)	145 (59.4)	22 (9.0)	21 (8.6)
Dairy	53 (21.7)	137 (56.1)	28 (11.5)	26 (10.7)
Snacks	92 (37.7)	109 (44.7)	16 (6.6)	27 (11.1)
Sugary drinks	97 (39.8)	116 (47.5)	15 (6.1)	16 (6.6)
Alcohol	216 (88.5)	15 (6.1)	4 (1.6)	9 (3.7)
Condiments	29 (11.9)	71 (29.1)	54 (22.1)	90 (36.9)
<i>Values are n (%). Fish and meat had identical archived response distributions across all participants; only one shared signal was retained in PCA.</i>				

Dietary-pattern analysis

The 14 dietary variables were factorable, although sampling adequacy was modest (KMO = 0.622). Bartlett's test of sphericity was significant (chi-square = 362.97, df = 91, $p < 0.001$). Parallel analysis supported retention of three components. After varimax rotation, the components were labelled plant-rich traditional, beverage-animal foods, and grain-condiment/snack. They explained 17.6%, 12.0%, and 9.4% of total dietary variation, respectively, for a cumulative 39.0%.

Factors associated with concurrent hypertension and diabetes

Higher monthly income showed the strongest adjusted association with concurrent screening positivity. For each increase to the next income category, the adjusted odds were 1.45 times higher (95% profile-likelihood CI 1.05–1.98; $p = 0.023$). However, after correction for the 11 adjusted exposure tests, the false-discovery-rate q value was 0.251, so this association did not meet the prespecified multiple-testing threshold. None of the measured socioeconomic, lifestyle, or dietary-pattern exposures remained statistically significant after false-discovery-rate correction.

Meal skipping and the grain-condiment/snack dietary pattern produced some of the larger non-income effect estimates, but their confidence intervals included the null and their adjusted p -values were not statistically significant. Living with a smoker produced an inverse point estimate with a wide confidence interval; this was not interpreted as evidence of a protective effect.

Sensitivity analyses

Results were directionally similar when more specific outcome definitions were used. With the symptomatic-glucose definition, 28 participants (11.5% of the analytic cohort) met the concurrent outcome and the adjusted income trend was 1.69 (95% CI 1.19–2.40; $p = 0.003$). With the diagnosis-only definition, 16 participants (6.6%) met the concurrent outcome, and the adjusted income trend was 1.78 (95% CI 1.15–2.77; $p = 0.009$). After excluding records with repeated participant identifiers, the primary screening outcome remained 36/240 (15.0%), and the adjusted income estimate was 1.44 (95% CI 1.04–1.97; $p = 0.026$). These sensitivity analyses support a possible socioeconomic gradient, but they remain exploratory and should be interpreted together with the multiple-testing results.

Discussion

This community-based study provides contemporary evidence on the coexistence of hypertension and diabetes and their socioeconomic, lifestyle and dietary correlates among adults in Southwestern Nigeria. Most participants in the analytic cohort had hypertension alone, while a smaller proportion had diabetes alone or both conditions. Higher monthly income produced the strongest positive association with concurrent hypertension and diabetes across the main and sensitivity analyses, although the association did not remain statistically significant after correction for multiple testing. More than half reported meal skipping, fewer than one-third reported regular physical activity, and smoking and current alcohol use

were uncommon. Three dietary patterns were identified, but none was independently associated with the combined outcome.

The community burden is broadly consistent with earlier Nigerian evidence. Bello-Ovosi et al. reported concurrent hypertension and diabetes in 6.7% of adults in an urban Kaduna community, with hypertension and diabetes prevalences of 55.9% and 23.8%, respectively [10]. In Malawi, Price et al. similarly documented substantial burdens of hypertension and diabetes in both rural and urban populations [19]. Outside Africa, Wu et al. found coexistence in 2.8% of 25,356 Chinese adults and showed strong relationships with lifestyle and obesity [20]. The lower Chinese estimate may reflect differences in age distribution, diagnostic procedures and background cardiometabolic risk.

The low level of regular physical activity in this study agrees with findings from Southwestern Nigeria. Aduroja et al. reported low physical activity in 87.2% of 500 semi-urban Ibadan residents, while adequate fruit and vegetable consumption was reported by only 33.0% and 36.4%, respectively [7]. The absence of an independent physical-activity association here may partly reflect the frequency-based assessment, which did not capture duration or intensity, as well as the relatively small number with both conditions. Dietary findings also require cautious interpretation. Khaledi et al. demonstrated that salt-reduction behavioural interventions can reduce salt consumption and blood pressure in adults [21]. Subsequently, a West African meta-analysis by Batubo et al. found 25% higher odds of hypertension with high salt intake and 17% higher odds with alcohol consumption, while greater fruit and vegetable intake was protective [6]. These findings contrast with the null associations for table-salt use, alcohol and dietary patterns in the present analysis, but those studies primarily examined hypertension rather than the more restrictive combined hypertension-diabetes phenotype.

Broader African evidence suggests that chronic-disease clustering increases with urbanization and ageing. Price et al. reported age-standardized multimorbidity prevalences of 22.5% in urban Malawi, 11.7% in rural Malawi, 2.9% in rural The Gambia and 8.2% in rural Uganda [22]. Although their definition included conditions beyond hypertension and diabetes, the substantially higher burden in urban Malawi is consistent with the influence of demographic and lifestyle transition. This is relevant because the present analytic cohort was predominantly middle-aged or older and drawn from urban and peri-urban communities.

The positive income signal observed here deserves particular caution. Among 762 hypertensive adults from Oyo, Abia and Kano States, Salawu et al. found that 81.1% had unhealthy lifestyle practices, yet those earning above ₦30,000 monthly were 1.58 times more likely to report healthy lifestyle practices than lower-income respondents (95% CI 1.05–2.38) [23]. This suggests that higher income may improve access to healthier choices and healthcare, but it can also accompany sedentary occupations, greater access to energy-dense foods and more frequent disease detection. In contrast, Ajayi et al. found that lower income and lower educational attainment were associated with higher ambulatory blood pressure among adults in semi-urban Ekiti State [9]. These contrasting Nigerian findings indicate that

socioeconomic position may operate differently for isolated hypertension and for hypertension-diabetes coexistence; therefore, the present income association should be considered hypothesis-generating.

Meal skipping was common and produced one of the larger, although non-significant, estimates. Kang et al., analysing 28,530 Korean adults, found that breakfast skipping among adults aged 19–44 years was associated with a 1.33-fold higher risk of hyperglycaemia (95% CI 1.14–1.54), whereas skipping dinner among older adults was associated with lower risk [24]. Such age-specific effects may be obscured by a single overall measure of meal skipping. Similarly, the inverse point estimate for living with a smoker should not be interpreted as protective. Flor et al. found consistent evidence that secondhand smoke increases cardiovascular risk [25], making residual confounding, exposure misclassification and limited statistical power more plausible explanations.

More recent Nigerian evidence further supports integrated cardiometabolic screening. Bankole et al., screening 2,060 adults in Lagos, reported hypertension in 39.5% and diabetes in 2.5%; adults with normal blood glucose were 3.87 times more likely to have normal blood pressure [26]. Nwankwo et al. subsequently estimated pooled hypertension prevalence among Nigerian adults at 34.2%, with 41.7% in the South-West [3], highlighting the large population at risk of multimorbidity. Internationally, Zou et al. reported a weighted hypertension-diabetes comorbidity prevalence of 7.0% in Hainan, China, increasing from 1.6% among adults aged 18–39 years to 18.5% among those aged at least 60 years [27]. This marked age gradient is particularly relevant to the older profile of the present cohort.

The dietary-pattern findings contrast with very recent Southwestern Nigerian evidence. Faidat et al. identified four principal dietary patterns among 608 adults in Oyo and Kwara States. Highest adherence to a typical traditional pattern was associated with greater hypertension prevalence (PR 1.642, 95% CI 1.069–2.252), whereas high adherence to a fruit-and-vegetable pattern was protective (PR 0.408, 95% CI 0.258–0.646) [28]. Their physical-activity association also became non-significant after full adjustment. Differences in outcome definition, food-group construction and statistical power may explain why comparable dietary associations were not observed here.

This study benefits from probability-based community screening, explicit separation of the initial screening population from the screen-positive analytic cohort, dietary-pattern analysis, bias-reduced regression and sensitivity analyses. However, its cross-sectional design prevents causal inference; single-visit blood pressure and random glucose measurements were screening rather than confirmatory diagnostic assessments; lifestyle and diet were self-reported; and community identifiers were unavailable for cluster-adjusted analyses. The relatively small number with concurrent disease also reduced precision. Overall, the findings support integrated hypertension-diabetes screening in Southwestern Nigeria, but the observed socioeconomic gradient should be interpreted cautiously. Larger prospective studies using repeated blood-pressure measurements, confirmatory glycaemic testing and more detailed assessments of diet and physical activity are needed.

Conclusion

This study identified a meaningful burden of concurrent hypertension-diabetes screening positivity among community-dwelling adults in Southwestern Nigeria. Higher monthly income produced the strongest positive association with concurrent screening positivity and remained directionally consistent across sensitivity analyses; however, the association did not withstand correction for multiple testing and should therefore be regarded as exploratory rather than conclusive. None of the assessed lifestyle practices or dietary patterns showed an independent association after false-discovery-rate correction. These findings highlight the need to avoid assuming that cardiometabolic multimorbidity is concentrated only among socioeconomically disadvantaged groups and support integrated hypertension and diabetes screening across adult populations. Given the cross-sectional design and reliance on single-visit screening measurements, causal and diagnostic interpretations are limited. Larger prospective studies incorporating repeated blood-pressure measurements, confirmatory glycaemic testing, detailed dietary assessment, and objective measures of physical activity are needed to clarify the socioeconomic and behavioural determinants of concurrent hypertension and diabetes in Nigeria.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Osun State Health Research Ethics Committee, Ministry of Health (OSHREC/PRS/569T/1102; approved 4 August 2025). Verbal informed consent was obtained under the approved study procedures. Participation was voluntary and participant confidentiality was maintained.

Consent for publication

Not applicable. The manuscript contains no identifying images or directly identifying clinical details.

Competing interests

The authors declare no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRedit authorship contribution statement

OSA: Conceptualization. OSA, OAA, PO, AOO, FTJ: Data collection; Writing - original draft; Writing - review and editing. PO: Formal analysis.

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Author Contribution

OSA: Conceptualization. OSA, OAA, PO, AOO, FTJ: Data collection; Writing - original draft; Writing - review and editing. PO: Formal analysis.

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Data Availability

The participant-level dataset is not publicly available because of ethical and confidentiality considerations but may be available from the corresponding author on reasonable request and subject to the applicable ethics and data-governance requirements.

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Figures

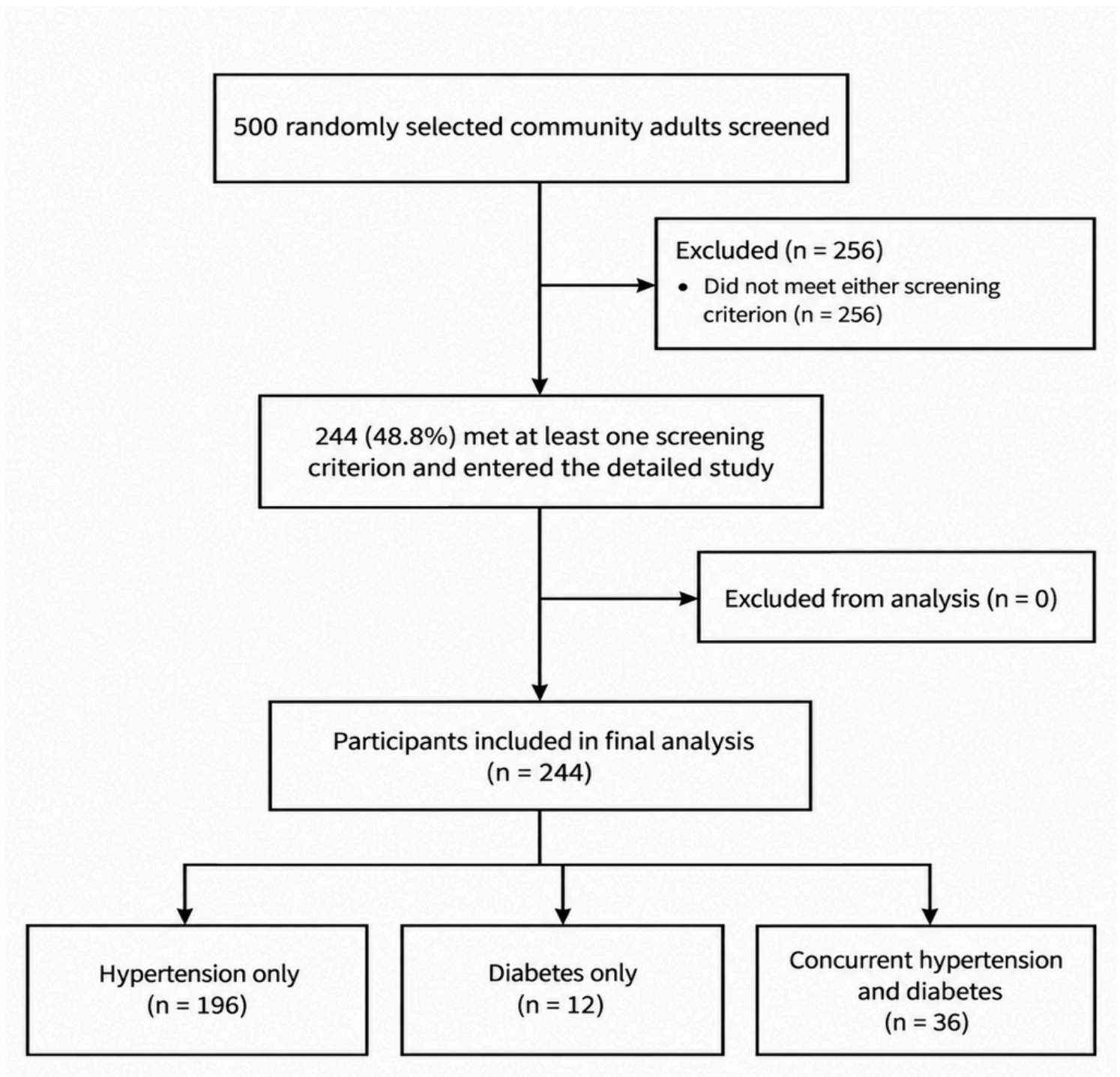


Figure 1

Participant screening and inclusion flow.