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Dietary inflammatory index and pre-hypertension among adults in two sub-Saharan African countries

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Abstract

Background Hypertension is increasingly prevalent globally. Pre-hypertension is associated with cardiovascular mortality but often overlooked, particularly in sub-Saharan Africa, where healthcare resources are limited. The Dietary Inflammatory Index (DII) evaluates the inflammatory potential of dietary patterns, which may influence pre-hypertension risk. This study aims to investigate the relationship between DII and pre-hypertension among adults, highlighting the need for effective dietary interventions.

Methods A muti-center cross sectional study involving 284 adult non-hypertensive patients was conducted in Nigeria and the Democratic Republic of Congo (DRC). Dietary habits were assessed using the Dietary Inflammatory Index (DII), while pre-hypertension was assessed using auscultatory method with a sphygmomanometer and stethoscope, following recommended guidelines. Data analysis included descriptive statistics, chi-square tests, and logistic regression.

Results Of 279 respondents who completed the study, 56.3% had pre-hypertension while 48.4% had high DII (pro-inflammatory). Prevalence varied across age groups, ethnicities, and study sites. Although, DII did not significantly predict pre-hypertension in this study, underweight (aOR = 0.26, CI = 0.07–0.98, p = 0.047), and younger age (aOR = 0.25, CI = 0.08–0.74, p = 0.013), were independently associated with reduced pre-hypertension risk.

Conclusion Pre-hypertension is common among adults in Nigeria and DRC. Dietary inflammatory index did not influence pre-hypertension; however, age and BMI are critical factors that influence the risk of pre-hypertension.

Keywords Dietary inflammatory index, Pre-hypertension, Adults, Sub-saharan Africa

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Introduction

Hypertension is fast becoming a global health issue with increasing prevalence in many countries particularly in sub-Saharan Africa [1]. Research indicates a concerning trend in the progression from pre-hypertension to hypertension, particularly within African populations. Studies reveal that a substantial percentage of individuals with pre-hypertension eventually develop hypertension, contributing to the escalating burden of cardiovascular disease on the continent [2, 3]. Thus, highlighting the importance of preventive strategies such as monitoring pre-hypertensive individuals, as timely interventions can significantly alter the progression to hypertension [3].

Pre-hypertension is linked to higher cardiovascular and all-cause mortality but has received less attention due to healthcare systems prioritizing the treatment of established hypertension and cardiovascular diseases. In low-resource settings, the focus is often on managing acute conditions rather than investing in preventive care for pre-hypertension [4, 5].

Pre-hypertension has been reported to be an intermediate stage towards the development of hypertension [5]. It is a condition that often occurs alongside other risk factors for severe cardiovascular events. Implementing non-pharmacologic treatment at this stage can offer significant clinical benefits to affected individuals and may help prevent or delay the progression to hypertension [5, 6]. According to the 7th Joint National Committee on prevention, detection, evaluation and treatment of hypertension (JNC 7), pre-hypertension is defined as systolic blood pressure (SBP) between 120mmHg and 139mmHg, and/or diastolic blood pressure (DBP) between 80mmHg and 89mmHg, while hypertension is defined as SBP of 140mmHg or more and/or DBP of 90mmHg or more [7, 8]. The burden of pre-hypertension is rising in low-income countries, including sub-Saharan Africa, likely due to economic growth and the adoption of Western diets. These diets, which are often high in inflammatory foods, contribute to the increasing prevalence of prehypertension in the region [7, 9].

Globally, about one-third of the population is estimated to have pre-hypertension, with a higher prevalence in men than women [8, 10, 11]. In the United States, the prevalence was 28.2% between 2010 and 2011 [12, 13]. In Africa, the prevalence ranges from 32.9 to 56.8% among adults [9, 14]. Specifically, pre-hypertension rates were 30.7% in Ghana, 30.9% in Nigeria, 36.9% in Uganda, and 30.3% among urban dwellers in the Democratic Republic of Congo [15, 16].

It has been shown that there is a link between pre-hypertension and pro-inflammatory markers like C-reactive protein, and pre-hypertension itself may be a pro-inflammatory condition [10, 11]. For instance, the pathophysiology of cardiovascular diseases was linked to inflammation, and the development of hypertension has been linked to diet with inflammatory characteristics [17, 18]. Increase in markers of chronic inflammation like interleukin-6, C-reactive protein, and other acute phase proteins to about 2 to 4 folds depicts chronic low-grade inflammation [19]. The accumulation of inflammatory cells in the kidneys is related to the development of hypertension and end-organ damage [19]. Also, there is a linear relationship between the development of hypertension and C-reactive protein and likewise other pro-inflammatory cytokines were related to elevated blood pressure through the effects of inflammatory cytokine on structural and functional alterations in blood vessels [19–21]. Prostaglandin E2 increases the norepinephrine-pressor response in pre-hypertension [20]. Cardiovascular diseases including hypertension are associated with pro-inflammatory responses and increased level of reactive oxygen species [22]. Similarly, elevation in blood pressure had been shown to partly result from chronic low-grade inflammation [19].

Within the African settings and most especially in sub-Saharan Africa, research has shown an increasing burden of non-communicable diseases (NCD), and this was attributed to the increase in nutrition transition from the African diets due to modernization and urbanization [23]. With the relative increase in economic growth and adoption of Western civilization in the sub-Saharan African region, there is an alarming rise in fast food outlets, which has been reported to be associated with diets and foods high in the dietary inflammatory index [22, 23]. These diets which are rich in saturated fats and sugars and low in fibers have been related to an increase in inflammatory cytokines, which has been linked to pre-hypertension [20–23].

Several studies have shown the relationship between diets and NCD but a few focused on the relationship between the dietary inflammatory index and pre-hypertension in the sub-Saharan Africa regions [19–22]. Thus, this study was carried out to determine the relationship between dietary inflammation and pre-hypertension among adults in Sub-Saharan Africa, and to add to the knowledge on prevention of cardiovascular diseases. In addition, studies have demonstrated the link between hypertension and cardiovascular disease [24, 25], more information is needed on the association between pre-hypertension and cardiovascular disease.

Methods

Study design and sites

The study is muti-center cross sectional study conducted in two countries in sub-Saharan Africa: Nigeria and Democratic Republic of Congo (DRC). The Nigeria study took place at the Family Medicine Clinic (FMC) of Aminu Kano Teaching Hospital (AKTH) in Kano, located in the Northwestern region, and at the Outpatient Clinic (OPC) of the General Hospital Ilorin in the Northcentral region. AKTH is an 800-bed facility with a Primary Care Unit (FMC) where all patients, except emergencies, are assessed, treated, and referred to other specialty units. This clinic serves approximately 91,000 adult patients each year. In contrast, General Hospital Ilorin has 450 beds and its OPC caters to about 30,000 adult patients annually.

The DRC study was conducted at Libikisi Hospital, part of the Baptist Community of Congo (CBCO), and Micha'gloire Medical and Surgical Hospital. Libikisi Hospital, with around 100 bed spaces, focuses on providing essential medical services, particularly in maternal and child health, infectious diseases, and general healthcare, seeing an average of 32,000 outpatients per year. Micha'gloire Medical and Surgical Hospital, which has about 80 bed spaces, offers a range of medical and surgical services to both inpatients and outpatients in the local community, averaging around 14,500 outpatients annually.

Study population
Study population involves all non-hypertensive patients aged 18years or older attending the Outpatient Clinics of the respective hospitals within the study period. Consenting patients aged 18years or older attending the Outpatient Clinics of the respective hospitals were recruited for the study, if they had a SBP < 140 mmHg and/or DBP < 90 mmHg, had no prior diagnosis of hypertension, and not on hypertension medications. Patients with fever (axillary temperature > 37.2°C) during recruitment, pregnant and lactating women; and patients with known chronic inflammatory medical conditions such as hypertension, diabetes mellitus, chronic kidney disease, chronic liver disease, malignancy or Human Immunodeficiency virus (HIV) were excluded from the study [25].

Sample size
Currently the Sub-Saharan population is 1.2 billion with Nigeria and DRC having 218.54 million and 99 million respectively [26].

The sample size was calculated using the standard formula: [27] $n = Z\alpha^2 pq/d^2 = 255$.

n = minimum sample size, Z_α =standard normal deviate of 1.96 corresponding to 95% confidence level. p = prevalence of pre-hypertension in Sub-Saharan Africa = 21%.[28] q = 1 − p (complimentary probability) = 79%. d = level of precision, set at 5% =0.05. Considering 89.7% response rate in a similar study in Sub-Saharan Africa, the sample size was adjusted (255/0.897) to **284**. Therefore, given the recent populations of Nigeria (218.54 million) and the DRC (99 million) mentioned above, Nigeria was allocated 195, (138 for Kano and 57 for Ilorin – based on their current population), whereas the DRC received 89.

Sampling method
Patients who meet eligibility criteria for the study were enrolled into the study using systematic sampling until the required sample size was obtained. The sampling frame (n) was determined for each study site and the first patient was selected by simple random sampling. Thereafter every nth patient was selected. This was continued daily until the required sample size was achieved.

Data collection
A semi-structured interviewer administered questionnaire was used for the study. It comprised 3 sections which include the Socio-demographic characteristics, Dietary Inflammatory Index (DII) and Food Frequency Questionnaire (FFQ), and physical examinations.

Dietary Inflammatory Index and Food Frequency Questionnaire: The DII is a tool that assesses the total quality of the diet of individuals focusing on the inflammatory potentials [21]. The frequencies of the food intake in the FFQ were allotted inflammatory scores in DII. Positive scores on the index imply a pro-inflammatory diet and negative scores typify an anti-inflammatory diet [21]. The tool measures individuals' food intakes, and the overall inflammatory potential of their diets. It comprises a list of diet that are categorized on a continuum from maximally anti-inflammatory to maximally pro-inflammatory. The scoring algorithm entails awarding a score of '+2 or + 1' if the dietary effects were pro-inflammatory (i.e. significantly increases IL-6, or CRP); '- 2 or -1' if the effects were anti-inflammatory (significantly decreases IL-6, or CRP); and '0' if the food parameter did not produce any significant change in the inflammatory marker [27]. The DII scores was classified according to Shivappa et al.: high (> + 0.5), medium (-0.5 to + 0.5) and low (< -0.5) inflammatory index [29].

The Physical examination includes weight, height, body mass index (BMI), temperature and blood pressure (BP). The axillary temperature was measured with the Thomasnet® digital thermometer. The BP of each patient was measured by auscultatory method using standard Accuson® mercury sphygmomanometer with an appropriate-sized cuff and a Littman® stethoscope in keeping with recommended guidelines [30]. The measurements was performed twice in the left and right arm at an interval of at least five minutes. The arm with the highest average was used for recruitment into the study. The BP reading was recorded to the nearest 1mmHg. Patients having SBP of 120–139 mmHg and /or DBP of 80–89 mmHg was classified as pre-hypertension while those with SBP < 120 mmHg and DBP < 80 mmHg was classified as normal BP [30].

Weight in kilograms was measured to the nearest 0.1 kg using a standard Hanson® bathroom weighing scale with the patient lightly clothed, bare-footed and devoid of any heavy object such as handbags, cell phones and bunch of keys. The scale was chosen due to limited resources and to ensure consistency, as it is readily available in all centers. It was adjusted to zero point before each weighing. The reliability of the weighing scale was checked from time to time by measuring a known weight on the scale. The height was measured to the nearest 0.1 m using a Seca® 274 free standing stadiometer, with the patient standing erect bare footed against the stadiometer looking straight ahead, without a scarf or cap. The horizontal bar of the stadiometer was brought to rest lightly on the vertex of the patient's head and the height read off on the vertical ruler. The BMI was calculated by the division of the subject's weight in kilograms (kg) by the square of their heights in meters (m [2]). BMI < 18.5 Kg/m^2 = underweight; 18.5–24.9 Kg/m^2 = Normal; 25.0-29.9 Kg/m^2 = Overweight; ≥ 30.0 Kg/m^2 = Obesity.

Table 1 Sociodemographic characteristics (*n* = 279)

Variables	Frequency	Percentage
Age groups (Years)		
18–40	176	63.1
41–60	79	28.3
>60	24	8.6
Mean ± SD = 37.84 ± 14.51		
Gender		
Male	157	56.3
Female	122	43.7
Study sites		
Kano	156	55.9
Ilorin	46	16.5
CBCO	60	21.5
Michagloire	17	6.1
Ethnicity		
Nigeria (*n* = 202)		
Fulani	43	21.3
Hausa	98	48.5
Igbo	4	2.0
Yoruba	51	25.2
Others	6	3.0
DRC (*n* = 77)		
Kongo	22	28.6
Luba	23	29.8
Ngala	26	33.8
Shahili	6	7.8
Educational status		
No formal	61	21.8
Primary	20	7.2
Secondary	101	36.2
Tertiary	97	34.8
Occupation		
Private sector	26	9.3
Public sector	70	25.1
Schooling	46	16.5
Self-employed	77	27.6
Unemployed	60	21.5

Others: Kanuri, Ebira, Igala, Tiv, SD: Standard deviation, CBCO: Libikisi Hospital of the Baptist Community of Congo, DRC: Democratic Republic of Congo

Data analysis

Data was collected using the Kobotoolbox software and exported to the Excel software for cleaning. Data was then exported to IBM SPSS version 23 statistical software for analysis. Frequencies and percentages were used to describe categorical variables. Means and standard deviation were used to describe continuous parametric variables. Normality was determined using the Shapiro-Wilk Test. Chi square was used to test for significance between categorical variables. Where > 20% of cells contained values less than 5, Fischer's exact test was used to assess the significance of the association. Binary logistic regression was used to identify the predictors of pre-hypertension and a p-value of ≤ 0.05 was considered statistically significant.

Results

A total of 279 respondents (Kano – 156, Ilorin – 46 and DRC – 77) completed the study to give an overall response rate of 98%. The deviations in sample sizes were not intentional but resulted from adjustments during data collection. In Kano, the sample size was increased to 156 due to unexpectedly high recruitment rates, while in Ilorin, recruitment challenges reduced the sample to 46 participants. Their ages ranged from 18 to 85 years with mean age of 37.84 ± 14.51 years. Table 1 showed that majority (63.1%) of the respondents belonged to the age group of 18–40 years and are predominantly males (56.3%) with male to female ratio of 1.3:1. Among the study sites Kano had the highest representation 156 (55.9%) followed by CBCO 60 (21.5%) while Michagloire had the lowest 17 (6.1%). The Hausa tribe had the highest representation 98 (48.5%) in Nigeria while Ngala tribe 26 (33.8%) had the highest in DRC. Most of the respondents had either secondary (36.2%) or tertiary (34.8%) level of education. About three quarter (74.2%) of the respondents were either unemployed (21.5%), self-employed (27.6%) or employed in the public sectors (25.1%).

As shown in Table 2, the SBP of the respondents ranged from 90-138mmHg with mean of 118.36 ± 10.89mmHg while DBP ranged from 50-89mmHg with mean of 75.05 ± 8.68mmHg. A total of 122 (43.7%) had normal BP while 157 (56.3%) had pre-hypertension, which gave the prevalence of pre-hypertension in this study to be 56.3%. Also, Fig. 1 showed that respondents in Ilorin study site in Nigeria have the highest (78.3%) prevalence of pre-hypertension while the prevalence was almost similar

Table 2 Clinical characteristics ($n = 279$)

Variables	Frequency	Percentage
Blood pressure		
Normal	122	43.7
Pre-hypertension	157	56.3
SBP = (90-138mmHg)		
Mean ± SD = 118.36 ± 10.89		
DBP = (50-89mmHg)		
Mean ± SD = 75.05 ± 8.68		
Body mass index (BMI)		
Underweight	19	6.8
Normal	143	51.3
Overweight	76	27.2
Obese	41	14.7
Mean ± SD = 24.92 ± 4.76		
Dietary inflammatory index (DII)		
High	135	48.4
Medium	45	16.1
Low	99	35.5
Mean ± SD = 0.63 ± 4.31		

SD: Standard deviation, SBP: Systolic blood pressure, DBP: Diastolic blood pressure

in the other three sites. The mean BMI of the respondents was 24.92 ± 4.76 Kg/m^2 with a range of 16.80 to 42.52 Kg/m^2. A little above half (51.3%) had normal BMI while about a quarter (27.2%) were overweight followed by 41 (14.7%) who were obese. Close to half (48.4%) of the respondents had high DII (pro-inflammatory) while about a third (35.5%) had low DII (anti-inflammatory). The highest DII (76.5%) was found among respondents in the Michagloire site in DRC while those in Ilorin had the lowest DII (26.1%). Figure 1.

As illustrated in Tables 3 and 4, among the sociodemographic characteristics of the respondents, only age ($p = 0.003$), ethnicity ($p = 0.002$), and study sites ($p = 0.012$) have statistically significant associations with pre-hypertension. The prevalence of pre-hypertension worsens with advancing age and respondents in Ilorin site had the highest prevalence of pre-hypertension. In addition, the BMI of the respondents had a statistically significant ($p = 0.015$) relation with pre-hypertension, such that the prevalence of pre-hypertension worsens with increasing BMI. Further analysis revealed that age and BMI were the independent predictors of pre-hypertension in this study. The younger age group (18–40) years were 75.4% less likely to develop pre-hypertension while the underweight respondents were 73.7% less likely to have pre-hypertension. This study did not find an association between DII and pre-hypertension (Table 5).

Discussion

This study aimed to investigate the prevalence of pre-hypertension among respondents from three study sites (Kano, Ilorin, and DRC), as well as to explore the associations between pre-hypertension and various sociodemographic factors, BMI, and dietary inflammatory index (DII). The prevalence of pre-hypertension in the study was high at 56.3% and 48.4% of the respondents had high dietary inflammatory index. However, we found no relationship between the dietary inflammatory index and pre-hypertension. Advanced age and high BMI were the independent predictors of prehypertension in this study.

The prevalence of pre-hypertension in this study is similar to 58.7% and comparable to 49.6% reported in Sokoto and Ilorin, northwestern and northcentral Nigeria respectively [31, 32]. However, it is higher than what has been reported in some other studies. For example, a systematic review and meta-analysis in Nigeria reported a pre-hypertension prevalence of 30.9% among urban adults [10], a national survey in Uganda reported a

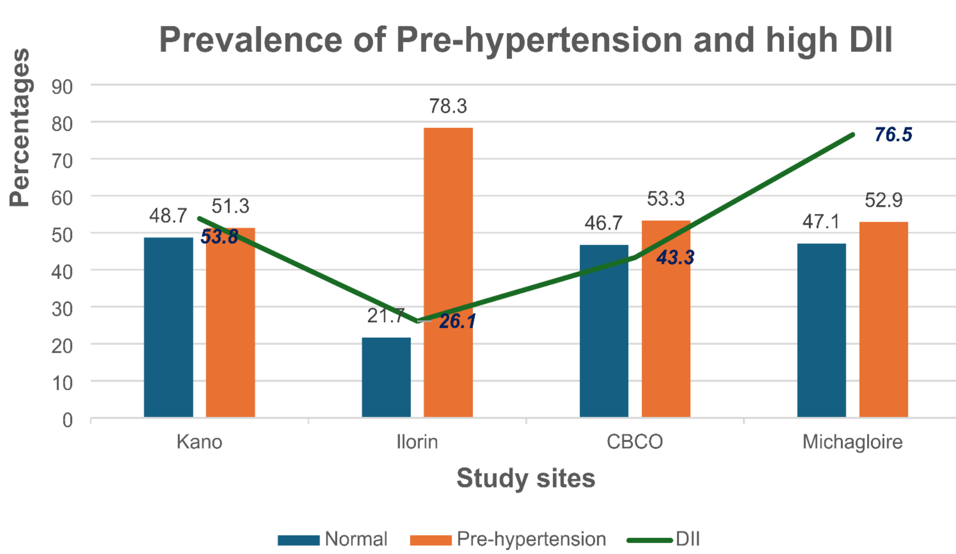

Fig. 1 Combo chart showing the prevalence of pre-hypertension and high DII in the study sites

Table 3 Socio-demographic/clinical factors and pre- hypertension

Variables	Normal (*n* = 122)	Pre-hypertension (*n* = 157)	χ^2	*p*-value
Age groups (Years)			11.967	**0.003**
18–40	90 (51.1%)	86 (48.9%)		
41–60	27 (34.2%)	52 (65.8%)		
>60	5 (20.8%)	19 (79.2%)		
Study sites			10.905	**0.012**
Kano	76 (48.7%)	80 (51.3%)		
Ilorin	10 (21.7%)	36 (78.3%)		
CBCO	28 (46.7%)	32 (53.3%)		
Michagloire	8 (47.1%)	9 (52.9%)		
Gender			9.007	0.933
Male	53 (43.7%)	69 (56.6%)		
Female	69 (43.9%)	88 (56.1%)		
Ethnicity			24.991*	**0.002**
Fulani	27 (62.8%)	16 (37.2%)		
Hausa	46 (46.9%)	52 (53.1%)		
Igbo	1 (25.0%)	3 (75.0%)		
Yoruba	11 (21.6%)	40 (78.4%)		
Others	1 (16.7%)	5 (83.3%)		
Kongo	11 (50.0%)	11 (50.0%)		
Luba	7 (30.4%)	16 (69.6%)		
Ngala	16 (61.5%)	10 (38.5%)		
Shahili	2 (33.3%)	4 (66.7%)		
Educational status			2.719	0.437
No formal	27 (44.3%)	34 (55.7%)		
Primary	8 (40.0%)	12 (60.0%)		
Secondary	50 (49.5%)	51 (50.5%)		
Tertiary	37 (38.1%)	60 (61.9%)		
Occupation			10.833	0.055
Private sector	10 (38.5%)	16 (61.5%)		
Public sector	29 (41.4%)	41 (48.6%)		
Schooling	29 (63.0%)	17 (37.0%)		
Self-employed	26 (33.8%)	51 (66.2%)		
Unemployed	28 (46.7%)	32 (53.3%)		
BMI			10.515	**0.015**
Underweight	12 (63.2%)	7 (36.8%)		
Normal	71 (49.7%)	72 (50.3%)		
Overweight	27 (35.5%)	49 (64.5%)		
Obese	12 (29.3%)	29 (70.7%)		

Bold: Statistically significant * Fisher's Exact Test

Table 4 Dietary inflammatory index (DII) and pre- hypertension

Variables	Normal (*n* = 122)	Pre-hypertension (*n* = 157)	χ^2	*p*-value
DII			4.441	0.109
High	66 (48.9%)	69 (51.1%)		
Medium	21 (46.7%)	24 (53.3%)		
Low	35 (35.4%)	64 (64.6%)		

Bold: Statistically significant

Table 5 Predictors of pre- hypertension

Variables	aOR	95% CI	*p*-value
Age group (years)			
18–40	0.25	0.08–0.74	**0.013***
41–60	0.39	0.12–1.25	0.114
>60	1		
Study sites			
Kano	1.04	0.05–18.12	0.998
Ilorin	1.10	0.10-11.99	0.937
CBCO	0.63	0.15–2.63	0.527
Michagloire	1		
Ethnicity			
Fulani	0.71	0.326–1.53	0.381
Hausa	0.38	0.03–4.58	0.451
Igbo	1		
Yoruba	1.59	0.19–13.26	0.667
Others	0.263	0.04–1.97	0.193
Kongo	0.53	0.06–4.52	0.568
Luba	1.60	0.22–11.44	0.641
Ngala	0.26	0.04–1.97	0.193
Sahili	1		
BMI			
Underweight	0.26	0.07–0.98	**0.047***
Normal	0.52	0.23–1.19	0.125
Overweight	0.26	0.05–2.27	0.331
Obese	1		

Bold*: Statistically significant, 95% confidence interval (CI), AOR = Adjusted Odd ratio, Reference category: age > 60 years, site Michagloire, Igbo and Sahili tribes, Obese

prevalence of 38.8%,[33] a population-based study in DRC reported a prevalence of 11.4%,[34] and large community-based study in central China reported a prevalence of 42.7%.[35] This could be due to the differences in the sample size with these studies having larger sample sizes as compared to our study. The higher prevalence observed in Ilorin (78.3%) compared to other sites could be due to regional variations in lifestyle and genetic predispositions [32].

Nearly half (48.4%) of respondents had a high DII, indicating a pro-inflammatory diet. This is similar to the findings from numerous studies [18, 19, 37–40]. This kind of diet increases the pre-hypertension and hypertension risk factors like obesity and being frail in the future [19, 20]. A South African study stated that those in urban areas had a high energy and high-fat diet which are pro-inflammatory compared to those in rural areas [41]. This finding is comparable since our study was conducted in the urban settings.

Age, ethnicity, study site, and BMI were significantly associated with pre-hypertension, with age and BMI being independent predictors. Younger respondents (18–40 years) were 75% less likely to develop pre-hypertension, and underweight individuals were 74% also less likely to have pre-hypertension. Previous studies also found significant associations between increasing age and higher BMI with elevated blood pressure levels, which is consistent with our findings [1, 4–6, 10, 13, 15].

Interestingly, no association was found between DII and pre-hypertension. This is similar to the findings among Japanese man [42], older adults in Taiwan [43], and US adults [44]. In contrast, several studies have suggested that a pro-inflammatory diet can contribute to the development of hypertension [17, 22, 36, 38]. This discrepancy could be due to differences in dietary assessment methods, or the specific population studied.

Although no association was found between the Dietary Inflammatory Index (DII) and pre-hypertension in our study, these results highlight the complexity of cardiovascular disease risk factors and the need for a more comprehensive approach to prevention. Our findings suggest that DII alone may not be a significant predictor of pre-hypertension in this population, and future research should explore other dietary, lifestyle, and genetic factors that contribute to cardiovascular risk. This information supports the importance of continuing to develop multifaceted prevention strategies rather than relying solely on dietary inflammatory measures.

There are several limitations to this study that should be acknowledged. The cross-sectional design limits the ability to establish causality between the identified risk factors and pre-hypertension. Also, the generalization of the findings of a hospital-based study of this type should be done with caution. The closed-ended questions of the DII may not have covered the whole range of answers relating to dietary history thus, a qualitative interview may be required in further studies. Additionally, the study's reliance on self-reported data for some variables may introduce reporting bias. The sample size, while adequate for initial analysis, may not be large enough to detect all potential associations, particularly for sub-group analyses (e.g., based on age, gender, location, or other characteristics). Furthermore, the study did not account for other potential confounding factors such as physical activity levels, dietary habits beyond DII, and genetic predispositions.

Future research should aim to address the limitations identified in this study. Longitudinal studies would be beneficial to establish causal relationships between sociodemographic factors, BMI, dietary patterns, and pre-hypertension.

Conclusion

This study reported high prevalence of pre-hypertension with high intake of proinflammatory diet in the studied regions. Age and BMI were the identified predictors of prehypertension. These findings underscore the importance of addressing risk factors, such as overweight and older age, to mitigate the burden of pre-hypertension and prevent its progression to hypertension in Nigeria and DRC.

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Author contributions
ALO was involved in the conception, design, data collection, analysis, interpretation, manuscript drafting, revision and approval for publication. KAM was involved in the conception, design, interpretation, manuscript drafting, revision and approval. OAO was involved in the conception, design, data collection, manuscript drafting, revision and approval. MKK was involved in the conception, design, data collection, manuscript drafting, revision and approval. BI was involved in the conception, design, manuscript drafting, revision and approval. ASI was involved in the design, analysis, manuscript revision and approval. TIAO was involved in the supervision, conception, design, data collection, analysis, interpretation, manuscript drafting, revision and approval.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
Ethical approval was obtained from the Ethics Committee of the study sites in the two countries. Nigeria: Kano (NHREC/28/01/2020/AKTH/EC/3618) and Ilorin (GHI/IRC/246/VOL.I/107); and DRC (UMJW/SGA/DEC/007/2023). Permissions was also obtained from the Heads of selected Departments, to be able to recruit patients into the study. An explicit explanation of the study was provided, after which the patients' informed consent was obtained through their signatures or thumb printing. Data was encrypted and stored in pass-worded computers to prevent unauthorised access.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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