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Systematic Review

# Investigating the Determinants and Preventive Approaches of Hypertension Among Adolescents in Nigeria: A Systematic Review Study

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## A B S T R A C T

**Introduction and Aim:** Hypertension in adults often begins in childhood and adolescence. African Region having 27% of the condition. This result in a significant health disparity with a rising prevalence of adolescent hypertension in Africa, particularly in Nigeria. This study aimed to investigate the determinants and preventive approaches of hypertension among adolescents in Nigeria.

**Methods:** This is a systematic review which follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The search strategy utilized several electronic databases include PubMed/MEDLINE, Embase, Scopus, CINAHL, Web of Science, and PsycINFO. The studies were selected based on predefined inclusion criteria, which include studies conducted in Nigeria or studies focusing specifically on healthy Nigerian adolescents (10-19 years), and published in English language from January 2013 to November 2023. The full text of the articles was thoroughly reviewed once the titles and abstracts had been screened to see if they met the predefined inclusion criteria. The selected articles with pertinent information were then presented in a data extraction sheet for further thematic analysis. Different themes and subthemes were developed by comparing the findings of the studies included that were similar.

**Results:** 25 of the 37 publications that underwent this analysis were further discarded because of insufficient information or inappropriate age limits. Finally, a comprehensive list of the 12 included studies was compiled. The review identified four key themes including, risk factors, societal disparity, Societal perceptions and preventive strategies associated with hypertension among adolescents in Nigeria. The research shown the significance of this public health issue, revealing varying hypertension rates across regions and gender disparities. Sedentary lifestyle, poor diet, obesity, age-related risk factors, and gender disparity emerged as key subthemes contributing to hypertension development among Nigerian adolescents.

**Conclusion:** Sedentary lifestyles, poor diet, obesity, age-related factors, and gender disparities contribute to hypertension. Urgent targeted interventions and public health programs are needed for better cardiovascular health in Nigerian adolescents.

**Keywords:** Hypertension, Adolescents, Preventive approach, Systematic review, Nigeria

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## 1. Introduction

In our rapidly advancing era of technology and improved healthcare, one might expect a decrease in the prevalence of

diseases, as well as a rise in life expectancy<sup>1,2</sup>. But over the past few decades a new trend has emerged. This trend, known as the epidemiological transition, is marked by an increase in the prevalence of chronic Non-Communicable Diseases (NCDs),

such as Cardiovascular Disease (CVD), cancer, injuries, and metabolic disorders such as diabetes<sup>3</sup>. Likewise, there has been a decrease in communicable diseases. The new trend can be observed through changes in mortality patterns, specifically in terms of causes of death, as well as changes in morbidity<sup>4</sup>.

On a global scale, NCDs have emerged as the leading cause of death, leading to the loss of around 41 million lives annually<sup>5</sup>. In fact, NCDs are responsible for over 70 percent of death globally, a number that is projected to increase over the next 15 years<sup>6</sup>. Moreover, it is predicted that Low and Middle-Income Countries (LMICs) would see the greatest rise in morbidity and death due to NCDs<sup>7</sup>.

According to the World Health Organization (WHO), Africa is set to witness a significant 10% rise in NCD-related mortality between 2015 and 2030<sup>6</sup>. This health disparity is caused by a number of factors, such as sedentary and unhealthy diets, as well as lifestyle changes. These shifts in lifestyle and health inequality are becoming more prevalent globally and are likely influencing the rising prevalence of chronic NCDs in LMICs<sup>7</sup>. This increase in chronic NCDs, particularly CVD, poses a significant global concern, impacting health outcomes and placing strain on healthcare systems worldwide<sup>8,9</sup>.

The rising burden of CVD in developing nations is alarming, and it is perhaps related to an increase in the incidence of cardiovascular risk factors, with hypertension playing a significant role<sup>10</sup>. Hypertension, or high blood pressure, is a major risk factor for CVD, including conditions like coronary heart disease, stroke, and heart failure<sup>11</sup>. It poses a considerable public health challenge, contributing to approximately 7.5 million deaths worldwide each year. This amounts to 57 million Disability Adjusted Life Years (DALYs), or 3.7% of all DALYs<sup>6</sup>.

Hypertension is often referred to as a silent threat since it is mostly asymptomatic, making it crucial to address proactively<sup>12</sup>. Although there may be no obvious symptoms, untreated hypertension can develop to serious health consequences such as heart disease, stroke, and kidney disease over time<sup>13</sup>. It is concerning that whereas average blood pressure levels have significantly decreased in developed countries, they have barely changed or even increased in most developing countries<sup>14</sup>. The WHO Region of the Americas has the lowest prevalence of hypertension (18%), with the African Region having the greatest prevalence (27%) of the condition. This result in a significant health disparity with a rising prevalence of adolescent hypertension in Africa, particularly in Nigeria<sup>15,16</sup>.

It is known that blood pressure in adults often begins in childhood and adolescence<sup>17,18</sup>. As such, early detection, diagnosis, and treatment of adolescents' hypertension are critical for reducing cardiovascular morbidity and death<sup>19</sup>. Nigeria is estimated to have a population of 191,835,936 and 22.3% of this population is adolescents. This percentage of the population is currently being faced with different CVD<sup>20</sup>. The country witness an increasing prevalence of hypertension among its adolescent population (ages 10-19)<sup>21</sup>.

There is a need to fill the gaps in the existing Literature on the prevalence and risk factors of hypertension among Nigerian adolescents. These gaps include limited awareness, varying prevalence rates, disparities in perception and knowledge, understanding of risk factors and their interactions, urban-rural disparities, and long-term consequences. Currently, majority

of adolescents in Nigeria lack knowledge about hypertension, and reported prevalence rates show variations. Also, there are disparities in perception and knowledge, which are influenced by factors such as rural residence. The complex interactions of risk factors require further exploration. It is crucial to understand urban-rural disparities and long-term consequences associated with adolescent hypertension

## 2. Materials & Methods

### 2.1. Search strategy

This is a systematic review which followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The search strategy utilized several electronic databases include PubMed/MEDLINE, Embase, Scopus, CINAHL, Web of Science, and PsycINFO. The selection of databases and sources was based on their relevance to this topic and the availability of studies focusing on hypertension among adolescents in Nigeria. A combination of keywords and search terms related to hypertension, adolescents, and Nigeria were used to capture relevant studies that focus on adolescent hypertension in Nigeria. Keywords and search terms used include "hypertension," "high blood pressure," "adolescents," "youth," "Nigeria," "prevalence," "risk factors," "prevention," and, prehypertension. Truncation, synonyms, and Boolean operators (e.g., AND, OR) were used to expand the search and ensure inclusiveness.

### 2.2. Selection criteria

The studies were selected based on predefined inclusion criteria, which include studies conducted in Nigeria or studies focusing specifically on healthy Nigerian adolescents (10-19 years), quantitative, qualitative or mixed method of studies examining hypertension prevalence, risk factors, perception, challenges, or preventive approaches, and studies that are published in peer-reviewed journals or other credible sources. We search databases to identify articles published from January 2013 to November 2023 (past 10 years)

### 2.3. Study selection

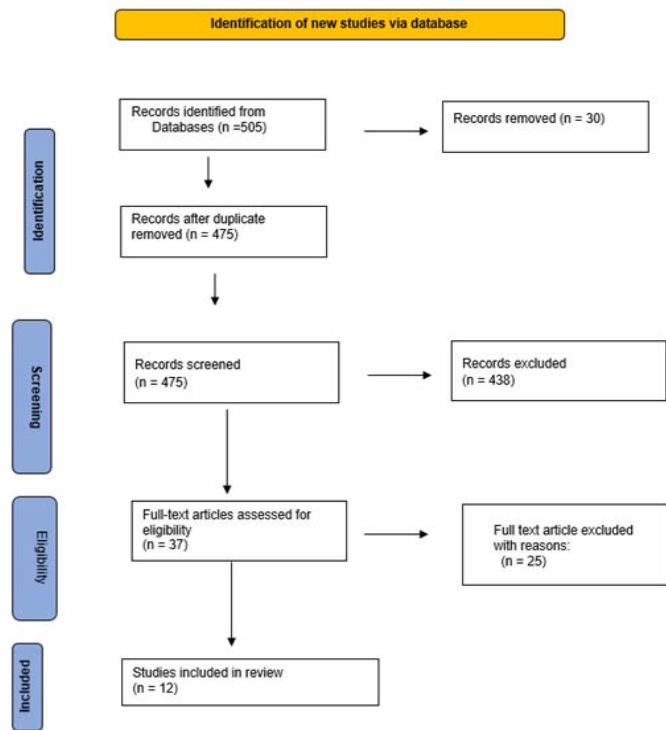
The approach started with finding relevant research in multiple databases, which produced a total of 505 publications. 30 articles were subsequently rejected as a result of identical titles. Following the initial identification stage, the 475 retrieved records underwent a screening phase, wherein predetermined inclusion and exclusion criteria were applied to titles and abstracts. Within this phase, 438 articles were excluded due to having unrelated titles and abstracts, thus refining the selection process.

The full text of the articles was thoroughly reviewed once the titles and abstracts had been screened to see if they met the predefined inclusion criteria. Twenty five of the 37 publications that underwent this analysis were further discarded because of insufficient information or inappropriate age limits. Finally, a comprehensive list of the 12 included studies was compiled (Figure 1).

### 2.4. Quality assessment

The final included studies were subjected to an assessment of bias using the Critical Appraisal Skill Programme (CASP) checklist for quantitative study, a tool designed for cross-sectional studies, which helped identify potential sources of bias

based on relevant checklist items. Overall, the studies generally fulfilled the basic criteria for reporting research findings. The review included twelve studies, each of which included clear information on a number of different topics, including the title, abstract, introduction, objectives, sample method, data collection, and measurement approach.



**Figure 1.** Article search and selection process

The twelve included studies were evaluated based on the research question, eligibility requirements, a risk-of-bias assessment and conflicts of interest. The tool consists of ten questions that evaluate both internal and external validity, including the suitability of the case definition, the validity of the study instrument, and the use of the same measurement methods for all subjects. We used a scoring system for each item in the CASP checklist, where a “Yes” was given a score of 1, a partial description, “somewhat” received a score of 0.5, and a “No” was scored as 0. The total CASP score was calculated by summing up these scores. A study will be considered to have a low risk of bias if it receives at least 8.5 out of a possible 10 points, a moderate risk if it receives 7 to 8.5, and a high risk if it receives 0 to 6 points<sup>22,23</sup>.

## 2.5. Data extraction

The data extraction process was conducted in a systematic

manner, involving a thorough review of each included study and the extraction of pertinent information using a standardized approach. To enhance accuracy and minimize bias, thorough review was carried out in each of the included studies in the data extraction process. Relevant data such as the author(s), publication year, study aims, study design, participant information, and outcomes were directly extracted from the full-text articles, research reports, or supplementary materials of the included studies, and organized using an Excel spreadsheet. To ensure consistency and structure, a data extraction form was developed to guide the systematic extraction of information from each of the included studies.

## 2.6. Data analysis/ Synthesis the result

The process of extracting data was conducted systematically by thoroughly reviewing each study included and extracting relevant information using a standardized method. This approach aimed to improve accuracy and reduce bias. Each included study underwent a comprehensive review during the data extraction phase. We directly obtained pertinent data from the full-text articles, research reports, or supplementary materials of these studies, organizing everything using an Excel spreadsheet. To ensure consistency and a well-defined structure, we created a data extraction form to systematically extract information from each study. The primary objective of this analysis was to uncover patterns, trends, and significant findings related to hypertension among adolescents in Nigeria. By comparing similar findings from the included studies, various themes and subthemes emerged. These themes and subthemes will be thoroughly analyzed and discussed in relation to the research objectives and existing literature.

## 3. Results

### 3.1. Study characteristics

The included studies in this analysis included a total sample size of 21,309 individuals, with participants ranging in age from 10 to 19. The distribution of male and female participants was roughly equal. In terms of research design, 85% of the studies were cross-sectional, while the remaining 15% were retrospective. The research was conducted in different regions of Nigeria. About 41% (5 studies) were carried out in the western part, 33% (4 studies) in the eastern part, and 25% (3 studies) in the northern part of the country.

Data from the included studies covered a ten-year period, from 2013 to 2023, and represented research done during that time. A significant percentage (66%) of the papers were published between 2017 and 2023 (**Table 1**).

**Table 1:** Data Extraction Sheet.

Study information	Objective	Participants	Study design	Results
<sup>24</sup> South - East, Anambra state Nigeria	To determine Prevalence and risk factors for adolescent hypertension in urban area South-East, Nigeria.	984 adolescents attending secondary schools aged 10-19 years.	Cross-sectional study	Hypertension: 6.3%. Prehypertension: 5.0%. Risk Factors: Obesity, type of school, sex , age, and family history
<sup>25</sup> Enugu, South East Nigeria	To determine the prevalence of hypertension among secondary school adolescents in Enugu South East Nigeria.	2,694 secondary school adolescents aged 10-18 years.	Cross-sectional survey.	Blood pressure increased with age. hypertension: 5.4%.prehypertension: 17.3%.
26 . South-west Nigeria	To establish the prevalence of pre-hypertension, lifestyle risk factors among rural adolescents.	1079 adolescents aged 15-18 year attending 22	Cross-sectional survey.	Hypertension less than 10%.
				No gender differences found.
				Significant; high BMI, age.

<sup>27</sup> Nigeria	To determine hypertension and identify risk factors for clinical hypertension in a new university intakes		6980 older adolescents (15-19 years)	Retrospective study (analysis of records)	Elevated BP: 25.1%, Stage 1 HTN: 19.8%, Stage 2 HTN: 5.5%. stage 2 HTN was significantly higher among male
<sup>28</sup> A b a k a l i k i Metropolis Nigeria	To determine the oscillometric blood pressure (BP) profile of apparently healthy secondary school adolescents		2401 students aged 10-19 years.	Cross-sectional survey	Alcohol use significantly associated with HTN. HTN 4.6%, higher in females.
<sup>29</sup> Maiduguri, Nigeria	To investigate and explore the prevalence of undiagnosed hypertension among adolescents in Maiduguri, Nigeria.		1,048 public secondary school students aged 13 to 18 years	descriptive cross-sectional design study.	Undiagnosed HTN 13.2%. 82.4% prehypertensive stage, while 17.6% as stage 1 HTN. Risk factor: BMI, parental income
<sup>30</sup> Ekiti State, Nigeria	To determine the prevalence of hypertension and associated factors among adolescents in Ekiti State.		416 secondary	cross-sectional survey.	HTN 10.1%. positive correlation between BMI and blood pressure risk factors gender and high BMI.
			School adolescents aged 10 to 19 years.		
<sup>31</sup> Nnewi, Southeast Nigeria	To determine the blood pressure profiles, association of obesity indicators, socioeconomic level, and physical activity		593 students aged 10-17 years	Cross-sectional survey	HTN 8.4%, pre-HTN 6.6%.
					Girls had a higher prevalence of HTN
<sup>32</sup> South-western Nigeria	To observe the relationship between adolescent weight status and blood pressure		1000 adolescents aged 10-16 years.	Cross-sectional study design.	HTN increase with age, higher HTN in urban areas. 3% obese, while 7.7% overweight. HTN 4%. Risk factor: being female, overweight, and obesity.
<sup>33</sup> Lagos state, Nigeria	To evaluate the impact of the 2017 American Academy of Pediatrics (AAP) Clinical Guideline on the prevalence of high blood pressure among adolescents		1,490 students aged 10-19 years	descriptive cross-sectional study.	HTN: 26.7% HTN: 12.9%. Using the 2004 Fourth Report, HTN 14.5%
<sup>34</sup> Rivers State, Nigeria	To determine and compare the blood pressure pattern and BMI of apparently healthy adolescents in rural and urban areas		2,136 adolescents aged 10-18 years	Cross-sectional.	HTN increased with age. Systolic and diastolic blood pressure correlated positively with BMI

**Table 2:** Quality Assessment.

Paper	1. Did the study address a clearly focused issue?	2. Was the cohort recruited in an acceptable way?	3. Was the exposure accurately measured to minimise bias?	4. Was the outcome accurately measured to minimise bias?	5. Have the authors identified all important confounding factors?	6. Have they taken account of the confounding factors in the design and/or analysis?	7. Do you believe the results?	8. Have ethical issues been taken into consideration?	9. Can the results be applied to the local population?	10. Do the results of this study fit with other available evidence?	score	Quality
<sup>24</sup> South-East, Anambra state Nigeria	+	+	+	+	+	+	+	+	+	+	10	High
<sup>25</sup> Enugu, South East Nigeria	+	+	+	+	-	Somewhat	Somewhat	-	+	+	7	Medium
<sup>26</sup> west Nigeria	+	+	+	+	+	+	+	+	+	+	10	High
<sup>27</sup> Nigeria	+	+	+	+	+	Somewhat	Somewhat	-	+	+	10	High
<sup>31</sup> Abakaliki Nigeria	+	+	Somewhat	somewhat	somewhat				Yes	somewhat		
<sup>29</sup> Maiduguri, Nigeria	+	+	+	+	somewhat	+	+	somewhat	+	+	9	High
<sup>30</sup> Ekiti State, Nigeria	+	+	+	+	somewhat	Somewhat	+	+	+	+	9	High

<sup>31</sup> Nnewi, Southeast Nigeria	+	+	+		somewhat	+	+	+	+	+	9.5	High
<sup>32</sup> South-western Nigeria	+	+	+	+	somewhat	Somewhat	+	somewhat	+	+	8.5	Medium
<sup>33</sup> Lagos state, Nigeria	+	+	+	+	+	+	+	+	+	+	10	High
<sup>34</sup> Rivers State, Nigeria	+	+	+	+	somewhat	+	+	somewhat	+	+	9	High
<sup>37,38</sup> Ilishan-Remo, Ogun State, Nigeria.	+	+	+	+	+	+	+	+	+	+	10	High

### 3.2. Prevalence of hypertension

This review include a total of 21,309 individuals aged between 10 and 19 from 12 studies with roughly equal gender distribution. The prevalence of hypertension among adolescents in various regions of Nigeria in the included studies ranging from 2.4% to 25.1 %. The prevalence of hypertension observed in the studies included a range of 2.4% to 25.1%. Examining different regions of Nigeria, it was found that in the eastern part, with a total of 6672 participants, the prevalence of hypertension varied from 2.4% in Nnewi, Southeast Nigeria<sup>31</sup>, to 6.3% in South-East Anambra state<sup>24</sup>. In the northern part, specifically in Maiduguri, Nigeria, the prevalence of hypertension was recorded at 13.2% among 1048 participants<sup>29</sup>. Shifting to the western part, the prevalence of hypertension ranged from 4.1% in South-western Nigeria<sup>32</sup>, to 12.9% in Lagos state<sup>33</sup>, with a total of 4473 participants. In the south-south region, specifically Rivers State, Nigeria, the prevalence was determined to be 11.5% among a participant of 2136<sup>34</sup>. In particular, one of the studies included in the review targeted University freshmen in Nigeria, revealing a particularly high prevalence of 25.1% among adolescents with a participant of 6980 (Table 3).

### 3.3. Findings from the included studies

The study findings revealed four main themes, each with specific sub-themes. The first theme is Related-risk factors, which includes six subthemes: sedentary lifestyle and poor diet, smoking and alcohol consumption, obesity and overweight, positive family history, age-related risk factor, and gender-related risk factor.

The second theme is societal disparity, which can be broken down into three subthemes: lack of awareness and education, environmental and economic stressors, and cultural factors.

The third theme is societal perceptions, comprising two subthemes: knowledge and awareness and healthcare-seeking behavior.

The fourth theme is Preventive Approaches and Strategies, which consists of three subthemes: lifestyle modification, regular health check-ups and screenings, and policy and environmental interventions.

**Table 3.** Description of the studies and prevalence of hypertension.

Study	Sample size	Age range	Gender distribution	Prevalence of hypertension
33	1,490	10-19 years	50% males, 50% females	12.90%
32	1000	10-16 years	50% males, 50% females	4.10%
31	593	10-17 years	50% males, 50% females	2.40%
30	416	10-19 years	50% males, 50% females	10.10%
29	1,048	13-18 years	62.3 %males, 37.7% females	13.20%
28	2401	10-19 years	49.81% males, 50.19% females	4.60%
27	6980	15-19 years	50% males, 50% females	25.10%
26	1079	15-18 years	46.55 % males, 53.5 % females	10%
25	2,694	18-Oct years	50% males, 50% females	5.40%
24	984	19-Oct years	47.7% males, 53.3% females	6.30%
37,38	488	19-Oct years	50% males, 50% females	10.50%
34	2,136	18-Oct	50% males, 50% females	11.50%

**Table 4.** Themes and subthemes identified in the included studies.

Theme	Subtheme
Risk factors	Sedentary lifestyle and poor diet
	Smoking and alcohol consumption
	Obesity and overweight
	Positive family history
	Age-related prevalence
	Gender-related prevalence
Societal disparity	Lack of Awareness and Education
	Environmental and economic stressors
	Cultural factors
Societal perceptions	Knowledge and Awareness
	Healthcare-seeking Behavior

Preventive Approaches	Lifestyle Modification
	Regular Health Check-ups and Screenings
	Policy and Environmental Interventions

## 4. Theme 1: Related-risk factors

### 4.1. Sedentary lifestyle and poor diet

Four (4) of the included studies focused on sedentary lifestyle and poor diet as risk factors for hypertension among Nigerian adolescents<sup>26,37,38,31</sup>. Identified these factors as significant contributors to hypertension. They found that adolescents with hypertension had a higher consumption of eggs, puff-puff (deep-fried dough), and carbonated drinks but lower vegetable intake. Similarly<sup>26,31</sup>, reported that adolescents with high cholesterol diets exhibited poor dietary behaviors, including low fruit and vegetable intake. However, one study by<sup>32</sup> did not find any significant association between poor physical activities and increased hypertension in adolescents.

### 4.2. Smoking and alcohol consumption

Among the 12 articles reviewed, 4 studies investigated the association between smoking, alcohol consumption, and blood pressure patterns among Nigerian secondary school adolescents. Two studies, <sup>26,28</sup> found a positive association, while<sup>25,30</sup> did not find any correlation or association.

### 4.3. Obesity and overweight

Eight studies consistently identified obesity and overweight as significant risk factors for hypertension development among Nigerian adolescents. Two studies<sup>29,30</sup> observed a weak positive correlation between BMI and blood pressure.

### 4.4. Positive family history

Only one study by<sup>28</sup> explored the association between a positive family history of hypertension and hypertension in adolescents.

### 4.5. Age-Related risk factor

Most of these studies 8 out of 9 found a positive correlation between age and pre-hypertension and found that hypertension was more prevalence in the older adolescents, while one study<sup>29</sup> observed a weak positive correlation.

### 4.6. Gender-Related risk factor

The majority of the studies (8 articles) indicated that females had a higher risk of hypertension or prehypertension compared to males. They also observed higher mean systolic and diastolic blood pressure in girls than boys. However, one study<sup>27</sup> indicated that males had a higher prevalence, and another study<sup>37,38</sup> did not find any gender differences.

## 5. Theme 2: Societal disparity

### 5.1. Lack of awareness and education

Only one study<sup>24</sup> highlighted limited knowledge and awareness about hypertension and its risk factors among adolescents in urban areas of South-East Nigeria.

### 5.2. Environmental and economic stressors

Three studies found socioeconomic disparities in the prevalence of high blood pressure among Nigerian adolescents. While<sup>30</sup> noted higher prevalence among students from lower socioeconomic levels, <sup>28, 29</sup> found that overweight and

obesity were more common among adolescents from higher socioeconomic backgrounds.<sup>32</sup> did not find any association between socioeconomic disparities and the prevalence of high blood pressure among Nigerian adolescents.

### 5.3. Cultural Factors

Two studies<sup>26,31</sup> discussed the impact of cultural beliefs on unhealthy lifestyle behaviors. They found that certain Nigerian cultures associate higher body weight in women with being well taken care of by their husbands, leading to low levels of physical activity among females.

## 6. Theme 3: Societal Perceptions

### 6.1 Knowledge and awareness

Three studies<sup>26,31,37,38</sup> emphasized the need for improved knowledge and awareness about hypertension among adolescents. Female physical activity was considered unusual or even stigmatized in some rural Nigerian communities.

### 6.2. Healthcare-seeking behavior

Only one study<sup>34</sup> examined healthcare-seeking behavior and attitudes toward hypertension management among adolescents attending public secondary schools in Maiduguri, Nigeria.

## 7. Theme 4: Preventive Approaches and Strategies

### 7.1. Lifestyle Modification

Two studies<sup>25,26</sup> emphasized the importance of lifestyle modifications, such as regular physical activity and a balanced diet, in preventing hypertension.

### 7.2. Regular health check-ups and screenings

Two studies<sup>31,33</sup> highlighted the need for regular blood pressure screenings and health check-ups for early detection and management of hypertension.

### 7.3. Policy and environmental interventions

Two studies<sup>26,31</sup> emphasized the role of policy interventions and creating supportive environments in preventing hypertension among Nigerian adolescents.

Thus, the findings identified key themes and subthemes related to the development of hypertension among Nigerian adolescents through evidence from the included studies.

## 8. Discussion

In our thorough review, which included a total of 21,309 individuals aged between 10 and 19 from 12 studies, we reviewed the incidence of hypertension among adolescents in different regions of Nigeria. The findings revealed a wide variation in hypertension rates, ranging from 2.4% to 25.1% in the included studies with the least prevalence observed in a study from Nnewi, Southeast Nigeria<sup>31</sup>.

This study set out with the aim of assessing the determinant and preventive approach to adolescent hypertension. With respect to the research question, significant observation from our study showed that female participants had higher prevalence of hypertension compared to males, especially among those classified as overweight or obese, as opposed to those with normal weight with 85% of the articles reviewed reporting this gender disparity. This finding differ from those carried out in other countries, such as the Korea National Health and Nutrition Examination Survey, where boys were more likely than girls to

have high blood pressure<sup>39</sup>. Similar results were observed in one of the included studies<sup>35</sup> where hypertension was also found to be more common among young males aged 10 to 19 years than among young females.

This gender discrepancy in hypertension prevalence could be attributed to various underlying factors, including cultural, behavioral, and biological aspects. For instance, hormonal changes related to the onset of puberty in females might play a role. Also, disparities in physical activity behavior between genders in certain regions of Nigeria could contribute to higher hypertension rates among females. Factors such as obesity, contraceptive use, unhealthy dietary habits, and elevated stress levels may also have varying impacts across different regions, contributing to the observed variations in hypertension prevalence. Moreover, contrary to their male counterparts, societal expectations and conventions may prevent adolescent females from participating in outdoor physical activities in many part of Nigeria<sup>28</sup>. These cultural influences could further contribute to the disparity in hypertension rates between genders.

The results of this review showed that age were positively correlated with hypertension, more than 75% of the articles (9 studies) emphasised that age is a risk factor for developing hypertension. What is curious about this result is that as adolescents grow older, they become more susceptible to developing elevated blood. However, this is not entirely true as environmental and behavioral factors could affect this stages as highlighted by<sup>29</sup>. Perhaps, the most compelling findings is that 66% of the articles (8 studies) consistently identified obesity and overweight as significant risk factors for hypertension. Comparison of the findings with those of other studies confirms that, hypertension rates were noticeably higher among adolescents who were obese or overweight in the majority of the studies considered. For instance, a study carried out in South-west Nigeria by<sup>26</sup> reviewed high BMI as key predictors of pre-hypertension. High BMI and older age were identified as significant risk factors for both genders in developing hypertension. Most often, high BMI are associated with high preference for fried food which emerged as a risk factor for females, while low breakfast cereal intake was a risk factor for males.

Another important finding is that in 25% of the studies analyzed, there was a significant association between higher socioeconomic disparities and higher hypertension prevalence. Though the findings from different studies were not entirely consistent, some studies observed a higher prevalence of hypertension among students from lower socioeconomic backgrounds, while others found higher rates of overweight and obesity among those from higher socioeconomic backgrounds.

Another finding that stands out from the results reported in this research is that there was a notable difference in the prevalence of hypertension between rural and urban areas, which contrasts with previous findings from<sup>40</sup>. While<sup>40</sup> reported a higher prevalence of hypertension in rural areas, our review (33% of them) showed that a significant proportion of adolescents with hypertension exhibited sedentary behavior and poor dietary habits, most of whom were from urban areas.

This shift in prevalence might be attributed to the increased consumption of unhealthy foods such as eggs, puff-puff (deep-fried dough), and carbonated drinks, which has become more pervasive in urban areas. Another potential factor could be the

different stages of the nutritional transition among the participants in each study. It is worth noting that urban/rural differences in hypertension prevalence may be specific to particular locations and region.

This rural-urban disparity in hypertension prevalence could be attributed to lifestyle differences between the two regions. Taken together, these results suggest that high rate of urbanization in many African countries might lead to lower levels of physical activity and a higher prevalence of sedentary lifestyles in urban areas. Nevertheless,<sup>25,26</sup> emphasized the importance of lifestyle modifications, particularly the need for regular physical activity and a balanced diet, in preventing hypertension among adolescents. Such expositions are unsatisfactory because in certain parts of Nigeria, including rural areas, high salt content in African food leads individuals to add even more salt to their meals, significantly increasing their overall salt intake<sup>37,38</sup>. Consequently, this excessive salt consumption greatly affects their blood pressure patterns<sup>37,38</sup> highlighted the significance of reduced sodium intake in diets, which can have a positive impact on blood pressure. These results are similar to those reported by<sup>41,42</sup> on the effect of sodium reduction on blood pressure in children and adolescents.

Studies investigating the potential relationship between smoking, alcohol consumption, and hypertension among Nigerian adolescents have yielded mixed findings. Whereas<sup>26</sup> did not find a significant association between blood pressure patterns and alcohol consumption and smoking<sup>26</sup>, found a contrasting result in their study, linking smoking and alcohol consumption to high blood pressure in both males and females.

Effective diagnosis and management of hypertension in Nigerian adolescents face numerous barriers, making primary prevention crucial. Thus far, the thesis has argued that lifestyle factors, age, gender, obesity have clear association with hypertension, and programs focusing on weight control through promoting balanced child and maternal nutrition, feeding schemes, and regular exercise can help reduce hypertension development<sup>26,31</sup> emphasized the role of policy interventions and creating supportive environments to prevent hypertension in this age group.

Without intervention, the prevalence of adolescent hypertension will likely continue to increase and persist into adulthood. Therefore, efforts should focus on implementing and expanding primary prevention programs, raising awareness among adolescents about hypertension and its risk factors, and creating supportive environments for healthier lifestyles. In order to reduce the prevalence of hypertension in Nigerian adolescents and improve their long-term health outcomes, these issues need to be addressed.

## 9. Limitations

The bulk of the research included in the review were conducted on students, and they revealed greater incidences of hypertension than those conducted in the community. The limitation of this approach is that several factors could influence blood pressure levels when measured in a school setting during activities like talking or active listening. Another significant limitation of the reviewed studies was the variability in blood pressure measurement methods. Different studies utilized diverse measurement techniques, which could impact the percentage of prevalence in the studies included. The majority of the studies in

the review were cross-sectional in nature, providing a snapshot of data at a single point in time.

Nevertheless, it's essential to consider the hypertension prevalence range with caution, as the included studies only covered specific regions in Nigeria, namely the northern, eastern, southern, and western parts as such the studies did not cover every state. It's important to note that the bulk of the article evaluations were carried out by the primary author alone. This was due to time constraints, resulting in limited input from a secondary reviewer.

## 10. Conclusion

This review highlights the prevalence, risk factors, and gender disparities in adolescent hypertension in Nigeria. Sedentary lifestyles, poor diet, obesity, age-related factors, and gender disparities contribute to hypertension. Tailored approaches, lifestyle changes, health check-ups, and policy interventions are essential for prevention. Urgent targeted interventions and public health programs are needed for better cardiovascular health in Nigerian adolescents.

Despite the well-documented mortality and morbidity linked to adult hypertension, as well as the increasing incidence of hypertension among Nigerian adolescents there is a lack of comprehensive understanding regarding the determinants, perception, awareness, and preventive approaches specific to hypertension among Nigerian adolescents. This study investigate the determinants and preventive approaches of hypertension, determine its prevalence, identify risk factors, assess the perception of adolescents towards hypertension, explore challenges faced, and evaluate the preventive approaches and strategies employed. By synthesizing existing literature, this research seeks to inform evidence-based interventions and policies that can effectively reduce the burden of hypertension and improve the long-term health outcomes of Nigerian adolescents. The study contributes to the academic literature on adolescent hypertension in Nigeria. Researchers can use the findings as a foundation for further investigations, building upon the identified themes and subthemes.

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