Delta Oghara Medical Journal

Volume 2, Issue 1. July, 2026.

DOMJ

ISSN: xxxx-xxxx

www.domj.org

Editorial Board

Editorial Advisory Board

ISSN: xxxx-xxxx

About the Journal

Delta Oghara Medical Journal

The Delta Oghara Medical Journal (DOMJ) is a peer-reviewed, open-access scientific journal dedicated to the advancement of medical science and clinical practice. Established in 2025, DOMJ serves as a vital platform for disseminating original research, comprehensive reviews, case studies, and expert commentaries across a wide spectrum of medical disciplines. Published biannually, the journal aims to foster academic collaboration and knowledge exchange among healthcare professionals, researchers, and academicians primarily within Nigeria and the broader global medical community. DOMJ is committed to maintaining the highest standards of scientific rigor and integrity through a robust double-blind peer review process. By providing unrestricted access to all its content, DOMJ promotes the free flow of scientific knowledge, facilitating improved healthcare delivery and outcomes.

Mission Statement

DOMJ's mission is to promote excellence in medical research and clinical practice by providing a reputable forum for high-quality, impactful publications. We strive to:

- Encourage the dissemination of innovative research and clinical advancements.
- Support interdisciplinary dialogue and collaboration among medical professionals.
- Advance evidence-based medicine through rigorous peer-reviewed scholarship.
- Highlight health, ethical, and social issues pertinent to Nigeria and the global medical community.
- Contribute to the education and professional development of clinicians, researchers, and students.

Scope and Coverage

The journal welcomes manuscripts that cover all aspects of medical science with special focus on clinical relevance and implications for patient care. Our scope includes but is not limited to:

- Internal Medicine and Subspecialties
- Surgery and Surgical Innovations
- Pediatrics and Neonatology
- Obstetrics, Gynecology, and Reproductive Health
- Public Health and Epidemiology
- Dentistry and Oral Health
- Pharmacology and Therapeutics
- Pathology and Laboratory Medicine
- Basic Medical Sciences and Translational Research

We particularly encourage submissions addressing diseases and healthcare challenges prevalent in Nigeria and Africa, as well as studies with global significance.

Editorial Process & Submission

Editorial Process

The editorial workflow at DOMJ is designed to ensure scientific accuracy, ethical compliance, and timely publication. Key steps include:

1. **Initial Screening**
   Manuscripts are assessed by the editorial team for suitability, originality, and compliance with submission guidelines.

2. **Double-Blind Peer Review**
   Suitable manuscripts are reviewed by at least two independent experts to provide constructive feedback and validate research quality.

3. **Revision and Acceptance**
   Authors may be asked to revise manuscripts based on reviewers' comments. Final decisions are made by the Editor-in-Chief and Associate Editors.

4. **Copyediting and Formatting**
   Accepted papers undergo professional editing to improve clarity, style, and adherence to journal format standards.

5. **Publication**
   Articles are published online under open-access policy, ensuring immediate availability to the global community.

Submission Guidelines

To maintain high-quality standards, authors should adhere to the following:

- Manuscripts must be original, unpublished work written in clear English.
- Include a structured abstract (250–300 words) covering Background, Methods, Results, and Conclusion.
- Use Vancouver referencing style with numbered citations in-text.
- Present ethical approval statements for studies involving human or animal subjects.
- Submit figures and tables as separate high-resolution files.
- Authors must disclose any conflicts of interest and funding sources.
- Manuscripts undergo a rigorous double-blind peer review process.
- No fees for submission, processing, or publication.

For detailed author instructions, visit the journal website at https://domj.org; or contact the editorial office.

Policies & Contact

Copyright & Licensing

Authors publishing in DOMJ retain copyright to their work while granting the journal the right of first publication. All articles are licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License (CC BY-NC-SA 4.0), allowing others to share and adapt the work for non-commercial purposes with appropriate credit.

Sponsorship & Archival Policy

DOMJ is proudly sponsored by the Medical and Dental Consultants Association of Nigeria (MDCAN), DELSUTH chapter. This sponsorship supports our commitment to open-access publishing without author fees. The journal is archived in LOCKSS and CLOCKSS systems to ensure permanent, secure access to published content.

Privacy Statement

DOMJ values the privacy of its contributors and readers. Personal data collected during manuscript submission and peer review is used solely for editorial purposes and protected against unauthorized disclosure. For more details, please refer to our privacy policy on the website.

Contact Information

Editorial Office
Delta Oghara Medical Journal
Delta State University Teaching Hospital
Oghara, Delta 333106, Nigeria

Email: managingeditor@domj.org
Phone: +234 913 198 2859

For inquiries about manuscript submission, editorial policies, or collaboration opportunities, please reach out to us.

www.domj.org

ORIGINAL ARTICLES

Table of Contents

ORIGINAL ARTICLE OPEN ACCESS

Malnutrition: Prevalence and Associated Factors among School Age Children in Delta State, Nigeria

John Esimaje Moyegbone[1*], Ezekiel Uba Nwose[2]

AFFILIATIONS

1 1Department of Environmental and Public Health, Faculty of Optometry, University of Benin, Benin City, Edo State, Nigeria.

2 2School of Health and Medical Sciences, University of Southern Queensland, Toowoomba, Australia

CORRESPONDING AUTHOR(S)

Dr. John Esimaje Moyegbone
john.moyegbone@uniben.edu
+2348052160088
ORCID: 0009-0000-3117-3762

ARTICLE HISTORY

Received 24/06/2026
Accepted 28/07/2026
Published 01/08/2026

ABSTRACT

Background:

Malnutrition continues to be a fundamental health problem across school-age children in poor resource countries, including Nigeria. Both undernutrition and overnutrition adversely affect physical and brain development, educational performance, and prospective health outputs.

Objective:

The objective of this research was to evaluate the frequency of malnutrition and identify factors influencing nutritional status of primary and secondary school children across Delta State.

Methodology:

Across Delta State, Nigeria, 201 primary and secondary school students between the ages of 6 and 17 participated in a cross-sectional survey. A multistage sampling process was employed to select study participants. Systematic questionnaire was employed to obtain information on dietary pattern and sociodemographic traits. Body Mass Index (BMI) percentile was computed using anthropometric data, such as height and weight. WHO growth references were used to categorize malnutrition based on age-for-height and sex. SPSS version 23 was utilized for data analysis. Chi-square test, multinomial logistic regression, and descriptive statistics were employed at 95% confidence threshold.

Results:

The study sample comprised 58.7% females and 41.3% males. Prevalence of thinness, overweight, stunting, and underweight was 14.9%, 5.0%, 7.0%, and 3.5%, respectively. Most respondents (80.1%) had normal nutritional status. Association between gender and nutritional status was statistically significant (χ^2 = 7.308, p = .026), prevalence of thinness was more common among males compared to females. Vegetable consumption was significantly associated with nutritional state (χ^2 =11.572, p = .003). Multinomial logistic regression showed that female gender was independently associated with reduce odds of thinness (AOR = .15, 95% CI: .024–0.951, p = .044).

Conclusion:

Despite the normal nutritional status of most school children, thinness and stunting remain important public health concerns. School-based nutritional interventions and health promotion of dietary consumption is recommended.

Malnutrition Nutritional status School-age children Thinness Undernutrition

INTRODUCTION

Malnutrition continues to be a fundamental health problem affecting children globally. It includes undernutrition, comprising micronutrient deficiencies, underweight, stunting, wasting, overweight and obesity. Worldwide, roughly 149 million children suffer from stunted growth (too short for their age), 45 million experience wasting (dangerously thin for their height), and over 37 million are overweight or obese.[1] Despite considerable progress in reducing childhood malnutrition, the burden continue to be unequally elevated in resource deprived nations, especially in South Asia and Sub-Saharan Africa, where endemic poverty, widespread hunger, along with inadequate healthcare services persist.[2] Malnutrition during childhood has immediate and prolong effects on health and developmental outcomes. Inadequate nutrition impairs physical growth, weakens immune function, increases susceptibility to infectious diseases, and contributes substantially to childhood morbidity and mortality.[3] Furthermore, poor nutritional status has negative effects on development of a child cognitive ability, educational performance, and prospective socioeconomic output. Children who experience undernutrition are more likely to have poor school performance, reduced adult earning capacity, as well as higher risk of acquiring chronic diseases manifestation in future.[4]

Conversely, childhood elevated body mass index (BMI) heightens susceptibility to hypertension, type 2 diabetes mellitus, cardiovascular diseases, including other non-communicable diseases in adulthood.[1] Although nutritional interventions have historically focused on children below five years of age, primary and secondary school children constitute an equally important but often neglected population group. School-age children undergo rapid physical, emotional, and cognitive development and require adequate nutrition to support optimal growth and learning. Nutritional deficiencies during this period can negatively affect school attendance, concentration, academic performance, and psychosocial well-being.[5] Furthermore, dietary habits established during childhood often persist into adulthood and influence lifelong health outcomes.[6]

Sub-Saharan Africa bears one of the highest burdens of childhood malnutrition globally. The region accounts for about one-third of all stunted children worldwide, and the prevalence of undernutrition remains unacceptably high.[2] Persistent poverty, food insecurity, climate change, conflicts, and inadequate healthcare systems have contributed immensely to continued elevated prevalence of inadequate nutrition in the region.[7] Nigeria bears one of the highest burdens of childhood malnutrition globally. According to the Nigeria Demographic and Health Survey (NDHS), approximately 37% of children below age five experienced stunted growth, 22% were underweight, and 7% were wasted.[8] Recent economic downturn and rising food inflation in Nigeria have further worsened household food insecurity and childhood malnutrition.[6] Studies conducted among school-age children in Nigeria have reported varying prevalence rates of malnutrition. A systematic review by Iheme[9] reported considerable regional differences in proportion of undernutrition in Nigerian school children, with thinness ranging from 5% to 29% and stunting ranging from 7% to 43%. Umeokonkwo *et al*.[10] reported prevalence of 15.7% and 9.9% for thinness and stunting, respectively in Ebonyi State school children. Similarly, Ayogu *et al*.[11] reported that undernourishment is a fundamental health challenge across school children in southeastern Nigeria. Determinants of malnutrition are multifactorial and include poverty, food insecurity, low parental educational status, low dietary habits, reoccurring infections, poor hygiene, and restricted access to healthcare interventions.[3] Dietary diversity, particularly low fruits and vegetables intake, plays significant function in achieving optimal nutrient profile because these foods provide essential vitamins, minerals, antioxidants, and dietary fibre required for growth and development.[1] Studies have shown that inadequate fruits and vegetables intake are linked to deficient nutritional outcomes in children.[12]

Delta State is one of Nigeria's economically important states with considerable urban and rural populations. Despite its economic significance, disparities in income distribution and access to quality nutrition persist, especially among children. Data on nutritional state of school children in Delta State are limited, thereby hindering evidence-based interventions and policies.

Our study aimed to evaluate the frequency and identify factors linked with malnutrition in Delta State children. The findings will provide empirical evidence for policymakers, educators, and public health practitioners in designing appropriate school-based nutrition interventions and contribute toward accomplishing Sustainable Development Goal 2, of putting an end to hunger and all varieties of malnourishment in 2030.[13]

MATERIALS AND METHODS

Design, Area and Population of Study

This research employed descriptive cross-sectional design. Geographical setting for the study was Delta State, a prominent province in Nigeria's Southern geopolitical zone. The State comprises three senatorial districts and twenty-five local government areas. The state has both City Areas and Villages with diverse sociocultural and financial characteristics. The inhabitants are predominantly engaged in farming, fishing, trading, and civil service activities.[14] The study population comprised school children between the ages of 6 and 17 attending public schools within Delta State, Nigeria.

Sample Size Determination and Sampling Technique

We applied the sample size formula to establish the appropriate number of subjects required for the study[15]:

$$n = \frac{Z^2pq}{d^2} = \frac{1.96^2 \times 0.099 \times 0.901}{0.05^2} = 137$$

where, n was minimum number of subject; Z was standard normal deviate at 95% confidence interval (1.96); p was estimated prevalence of malnutrition from previous Nigerian studies (9.9%)[10], q was 1 − p; d was degree of precision (0.05).

After adjustment for non-response, altogether, 201 respondents participated in our research. Multistage sampling technique was employed in our study. Delta State was stratified into the three senatorial districts. In the first stage, one local government was selected by simple random sampling (balloting) from each of the three senatorial districts making a total of three (3) local government areas for the survey. The local government areas randomly selected were Warri South (Delta South), Ethiope East (Delta Central) and Ukwuani (Delta North). In the second stage, one public primary school and one public secondary school was selected by balloting using simple random sampling from each of the three local government areas earlier selected making a total of three (3) public secondary schools and three (3) public primary schools in the three senatorial districts of Delta State. The schools sampled for the study were Ogiame Primary School, Warri and Essi College I, Warri (Delta South), Iwen Primary School, Eku and Abraka Grammer School, Abraka (Delta Central), Morka Primary School, Obiaruku and Amai Mixed Secondary Commercial School, Amai (Delta North).[16,17] In the third stage, 33 respondents from primary and secondary schools were enumerated from each of the selected three (3) primary and three (3) secondary schools. Respondents received consent forms a day in advance to indicate their willingness to participate survey. The research team then collected the contact details of their parents or guardians and reached out via phone. During these calls, the researchers explained the study's objectives and formally requested parental permission. Eligible pupils and students that gave assents and whose parent/guardian gave informed consents were then recruited into the study. The first 33 respondents from each of the six (6) schools that came with their consent forms signed were randomly recruited into the study making a total of 198 respondents. A total of three more respondents had consent forms signed and were included in the study making a total of 201 respondents.

Method of Data Collection

An interviewer-guided structured questionnaire was utilized to collect comprehensive background information, parental educational parental, status employment status, household income, and dietary practices including fruit and vegetable consumption. Frequency of fruits and vegetables consumption < three times weekly were considered low, while ≥ three times weekly fruits and vegetables

consumption were considered as adequate.[22] The questionnaire was made up of close ended, pre-designed and pre-tested questions. A two-day training workshop was organized to ensure the investigators were proficient with the data collection instruments and methodological protocols.

Nutritional Status Anthropometry

Anthropometric data were collected following WHO guidelines. Weight was recorded to the nearest 0.1 kg on a calibrated scale, and height was taken to the nearest 0.1 cm with a stadiometer. Body Mass Index (BMI) was determined using the following formula:

$$\text{BMI Percentile} = \frac{weight\ (kg)}{H\ (m)^2}$$

Measurements were taken in triplicate for each sample, with the averaged results serving as the basis for the analysis. Furthermore, the entire dataset was converted and presented as Z-scores. Height for age (stunted), BMI (thinness, normal, overweight or obese), weight for age (underweight) for participants were evaluated and matched with WHO reference values as standard.[18] Scores within two standard deviations of the median are classified as normal.[19] Children falling below -2 SD are categorized as underweight. Meanwhile, overweight and obesity are identified by weight-for-height z-scores exceeding +2 SD and +3 SD, respectively.[20,21]

Ethical Consideration

Ethical approved was obtained from the Ethics Committee, Central Hospital, Warri (protocol number: CHW/ECC VOL 1/243) and Eku Government Hospital, Eku (reference number: EBGH/AD/112/REM/V/101), Delta State. Institutional approval for school access was granted by the Chairman of the Local Education Authority and the Chief Inspector of Education. Additionally, written informed consent was secured from parents or guardians of participants, with verbal or written assent provided by the children themselves.

Method of Data Analysis

Researchers utilized SPSS (version 23) to process and analyze the dataset. Socio-demographic characteristics, anthropometric measurements, dietary consumption patterns of respondents were presented in tables, specifically frequencies, percentages, means, and standard deviations. Nutritional status was assessed using anthropometric indices. Selected socio-demographic variables and dietary habits relationship with nutritional state was examined using Chi-square (χ^2) test. Multinomial logistic regression analysis was subsequently done to consider independent predictors of nutritional status. Variables entered into the model included gender, age group, parental educational status, parental employment status, monthly parental income, fruit consumption, and vegetable consumption. Statistical significance was determined at probability value of less than .05, and the results were presented as adjusted odds ratios (AORs) accompanied by 95% confidence intervals (CIs).

RESULTS

The research involved a group of 201 school children. Females constituted majority of respondents (58.7%), while males accounted for 41.3%. Most respondents (64.2%) were secondary school students aged 12–17 years, whereas 35.8% were in elementary school age group (6–11 years). Regarding parental educational status, 43.8% of parents attended secondary school, 35.8% attended tertiary institution, and 20.4% either did not attend school or primary education. The majority of parents (89.1%) were employed, and approximately three-quarters (77.1%) earned ≤ ₦50,000 monthly. Furthermore, 72.1% of respondents had low fruit consumption, whereas 52.7% reported adequate vegetable consumption. The survey participants had an average age of 12.30 ± 3.14 years and an average Body Mass Index (BMI) of 17.43 ± 3.46 kg/m². Participants' mean weight and height were 40.84 ± 13.92 kg and 1.51 ± 0.16 m, respectively (Table 1).

Table 1: Socio-demographic Characteristics and Weekly Consumption of Fruits and Vegetables

Variables	Options	Frequency (n)	Percent (%)
Gender	Male	83	41.3
	Female	118	58.7
Age Group	Primary (6 - 11 years)	72	35.8
	Secondary (12 - 17 years)	129	64.2
Educational Status of Parent	None/Primary School	41	20.4
	Secondary School	88	43.8
	Tertiary School	72	35.8
Employment Status of Parent	Unemployed	22	10.9
	Employed	179	89.1
Income of Parents Per Month (Naira)	≤ 50,000	155	77.1
	> 50,000	46	22.9
Fruit consumption	Low fruit consumption	145	72.1
	Adequate fruit consumption	56	27.9
Vegetable consumption	Low Vegetable Consumption	95	47.3
	Adequate Vegetable Consumption	106	52.7

From Table 2, the prevalence of stunting among the respondents was 7.0%, while 93.0% had normal height-for-age. Among children aged 10 years and below, the prevalence of underweight was 3.5%, whereas 20.9% had normal weight-for-age. Based on BMI classification, 14.9% of respondents were thin, 80.1% had normal nutritional status, and 5.0% were overweight. These findings indicate that most children had optimal nutritional state, although considerable percentage experienced undernutrition.

Table 2: Prevalence of Malnutrition Parameters of Respondents

Variables	Options	Frequency (n)	Percent (%)
Stunting (height for age)	Stunting	14	7.0
	Normal	187	93.0
Underweight (weight for age ≤ 10 Years)	Underweight	7	3.5
	Normal	42	20.9
Body Mass Index (BMI)	Thinness	30	14.9
	Normal	161	80.1
	Overweight	10	5.0

Table 3 demonstrates the correlation between participants' nutritional status and their socio-demographic and dietary Characteristics. The data revealed a meaningful link between a person's gender and their nutritional well-being ($\chi^2 = 7.308$, $p = 0.026$). A greater proportion of males were thin compared with females (22.9% versus 9.3%), while overweight was slightly higher among females (5.9%) than males (3.6%). Vegetable consumption was significantly linked with nutritional state ($\chi^2 = 11.572$, $p = 0.003$). Respondents with low vegetable consumption had a higher prevalence of overweight (8.4%) than those with adequate vegetable intake (1.9%). No meaningful associations were noticed between nutritional status with age group ($p = 0.523$), parental educational status ($p = 0.053$), parental employment state ($p = 0.062$), parental income per month ($p = 0.335$), or fruit consumption ($p = 0.978$).

Table 3: Association between Malnutrition and Socio-demographic and Dietary Habits

Variables	Options	BMI (%)			χ^2	P-Value
		Thinness	Normal	Overweight		
Gender	Male	19 (22.9)	61 (73.5)	3 (3.6)	7.308	0.026
	Female	11 (9.3)	100 (84.8)	7 (5.9)		
Age Group (years)	Primary (6 - 11)	12 (16.7)	55 (76.4)	5 (6.9)	1.295	0.523
	Secondary (12 - 17)	18 (14.0)	106 (82.1)	5 (3.9)		
Educational Status of Parent	None/Primary School	6 (14.6)	33 (80.5)	2 (4.9)	9.324	0.053
	Secondary School	7 (8.0)	78 (88.6)	3 (3.4)		
	Tertiary School	17 (23.6)	50 (69.5)	5 (6.9)		
Employment Status of Parent	unemployed	7 (31.8)	14 (63.6)	1 (4.6)	5.568	0.062
	employed	23 (12.8)	147 (82.1)	9 (5.1)		
Income of Parents per Month (Naira)	≤ 50,000	20 (12.9)	127 (81.9)	8 (5.2)	2.188	0.335
	> 50,000	10 (21.8)	34 (73.9)	2 (4.3)		
Fruit consumption	Low fruit consumption	22 (15.2)	116 (80.0)	7 (4.8)	.045	0.978
	Adequate fruit consumption	8 (14.2)	45 (80.4)	3 (5.4)		
Vegetable consumption	Low Vegetable Consumption	7 (7.4)	80 (84.2)	8 (8.4)	11.572	0.003
	Adequate Vegetable Consumption	23 (21.7)	81 (76.4)	2 (1.9)		

Multinomial logistic regression model was employed to isolate independent predictors linked with nutritional status (Table 4). Female respondents had significantly lower odds of being thin compared with males (AOR = 0.15, 95% CI: 0.024–0.951, $p = 0.044$). The findings implies that females were approximately 85% less likely to experience thinness than males. Similarly, respondents with low vegetable consumption had significantly reduced odds of being thin (AOR = 0.053, 95% CI: 0.008–0.363, $p = 0.003$) in contrast to participants who consumed vegetables adequately. Age group, parental educational status, parental employment status, parental income, and fruit consumption did not significantly predict nutritional status ($p > 0.05$). Additionally, none of the independent variables significantly predicted the normal BMI category relative to the reference category. Furthermore, the multinomial logistic regression model was significant statistically (Likelihood Ratio $\chi^2 = 36.096$, df = 16, $p = 0.003$), indicating that the model significantly improved prediction of nutritional status compared with the intercept-only model. The pseudo-R^2 values showed that the independent variables explained between 14.7% and 23.3% of the variation in nutritional status (Cox and Snell $R^2 = 0.164$, Nagelkerke $R^2 = 0.233$, and McFadden $R^2 = 0.147$).

Table 4: Multinomial Logistic Regression Analysis to Identify Predictors of Malnutrition

BMI Percentile		B	Std. Error	Wald	P - Value	Exp(B)	95% CI for Exp(B)	
							Lower Bound	Upper Bound
Thinness	Intercept	3.810	1.413	7.276	.007			
	Gender (Female)	-1.896	.942	4.054	.044	.150	.024	.951
	Age Group [Primary (6 - 11)]	-1.207	.952	1.607	.205	.299	.046	1.933
	Parents Education (None/Primary)	-.630	1.148	.301	.583	.533	.056	5.053
	Parents Education (Secondary)	-.751	1.116	.453	.501	.472	.053	4.205
	Parents Employment Status (unemploy)	.725	1.256	.333	.564	2.065	.176	24.217
	Parents Income (≤ 30,000)	.049	1.075	.002	.964	1.050	.128	8.625
	Low Fruit Consumed (< 3x)	.696	.901	.597	.440	2.006	.343	11.741
	Low Vegetable Consumed (< 3x)	-2.936	.981	8.959	.003	.053	.008	.363
Normal	Intercept	3.712	1.308	8.055	.005			
	Gender (Female)	-.748	.822	.827	.363	.473	.095	2.372
	Age Group [Primary (6 - 11)]	-.573	.829	.478	.489	.564	.111	2.861
	Parents Education (None/Primary)	.280	1.001	.078	.780	1.323	.186	9.402
	Parents Education (Secondary)	.851	.972	.766	.381	2.343	.348	15.754
	Parents Employment Status (unemploy)	-.512	1.174	.190	.663	.599	.060	5.982
	Parents Income (≤ 30,000)	.004	.953	.000	.996	1.004	.155	6.499
	Low Fruit Consumed (< 3x)	.605	.778	.604	.437	1.831	.398	8.414
	Low Vegetable Consumed (< 3x)	-1.478	.863	2.932	.087	.228	.042	1.238

Reference Category: BMI (severe), Gender (male), Age Group [Secondary (12 - 17)], Parents Educational status (Tertiary), Parents Employment status (Employed), Parents Income (> 50,000), Adequate Fruit Consumed (> 3x), Adequate Vegetable Consumed (> 3x)

DISCUSSION

This research assessed the nutritional state and underlying factors in primary and secondary students across Delta State, Nigeria. Findings showed that although the majority of respondents had normal nutritional status, thinness, stunting, underweight, and overweight remain important public health concerns. The prevalence of thinness observed in our survey (14.9%) implies that approximately one out of every seven school-age children in the study area suffers from undernutrition. This prevalence is

comparable to the 15.7% recorded in the pediatric population attending schools in Ebonyi State, southeastern Nigeria[10] and is similar to findings reported in rural communities of southeastern Nigeria by Ayogu *et al*.[11] However, the prevalence is lower than the 20–30% reported among school children in some northern Nigerian communities.[23] The differences may be attributable to variations in socioeconomic status, dietary practices, food security, and geographical disparities.

The study found that 7.0% of the participants were stunted, which is lower than the national prevalence estimates among Nigerian children reported by the NDHS.[8] The lower prevalence may suggest some improvements in nutritional awareness and access to healthcare services in the study area. Nevertheless, stunting remains a concern because it reflects chronic poor nutrition. This condition is linked to delayed brain development, lower academic success, and reduced earning potential in adulthood.[4] Similar prevalence rates had been documented in poor resource countries among school-age children[24]

The study discovery of 5.0% participants with overweight supports emerging evidence of nutritional health transition in poor resource countries, where undernutrition and overnutrition coexist. Similar prevalence rates were documented among pupils across Ghana and Ethiopia.[25] However, the prevalence is lower than reports from urbanized areas of South Africa and developed countries, where childhood overweight and obesity exceed 15%.[1] This study demonstrates double burden of malnourishment, evidenced in both low body weight (thinness) and excessive weight coexistence in the population, phenomenon increasingly reported in many developing countries undergoing rapid urbanization and dietary transition.[2]

There was a statistically significant correlation between gender and nutrition, as males showed a markedly higher rate of thinness than females. Furthermore, multinomial logistic regression analysis showed that female respondents were approximately 85% less likely to be thin compared with males. This agrees with previous studies from Ethiopia and northern Nigeria that reported higher levels of undernutrition among boys than girls.[25,26] The higher prevalence of thinness among males may be due to increased energy expenditure, differences in growth patterns, and behavioural factors that predispose boys to greater nutritional demands.

Vegetable consumption was significantly associated with nutritional status. Children with adequate vegetable intake demonstrated better nutritional outcomes than those with low intake. Vegetables provide essential micronutrients like vitamins A, C, E, folate, along with minerals necessary for growth, immunity, and cellular function.[1] Several studies have reported that inadequate intake of fruits and vegetables puts school-age children at a higher danger of suffering from undernutrition and essential vitamin or mineral shortages.[6,12] This finding underscores the importance of promoting dietary diversity and increasing vegetable intake among school-age children.

Contrary to expectations, parental educational status, parental employment status, monthly income, and fruit consumption did not significantly associate with nutritional status. Corresponding results have been documented by Ayogu *et al.*,[11] who found that socioeconomic indicators were not independently linked with nutritional outcomes following adjustment for other variables. The lack of significant associations may suggest that nutritional status in this population is influenced by other unmeasured factors such as household food allocation patterns, dietary quality, nutritional knowledge, and recurrent childhood illnesses.

The insights from this research have significant impacts for shaping health policy. Firstly, the relatively high proportion of thinness indicates the need for routine nutritional screening and monitoring of school-age children. Secondly, the coexistence of undernutrition and overweight emphasizes the necessity for policies that will simultaneously address both types of nutritional abnormality. Thirdly, school-based nutrition programmes and health education interventions that promote healthy dietary practices and adequate daily intake of fruits and vegetables should be strengthened.

Furthermore, the findings support the implementation of comprehensive school health programmes, including periodic anthropometric assessment, nutrition counselling, and school feeding initiatives. Such interventions have the capacity to enhance nutritional outcomes, educational attainment, along with future productivity of children.

This research adds to the sparse data regarding the nutritional status of children attending primary and secondary school across Delta State, and provides baseline information for policymakers and public health practitioners. However, because this study used a cross-sectional design, we cannot determine cause and effect. In addition, behavioural as well as clinical elements like physical exercise, recurrent infections, and micronutrient profile were not evaluated. Future longitudinal studies incorporating dietary diversity indices, physical activity, and biochemical assessments are therefore recommended.

LIMITATIONS OF STUDY

This study has some limitations. The relatively small sample size and the inclusion of only one primary and one secondary schools from each senatorial district (three primary and three secondary schools in total) may limit the representativeness of the findings and reduce their generalizability to all school-age children in Delta State. In addition, although nutritional status was assessed using WHO-recommended anthropometric indicators, including BMI-for-age, height-for-age, and weight-for-age, other important dimensions of malnutrition, such as dietary diversity (apart from fruits and vegetables), micronutrient status (e.g., iron, vitamin A, zinc, and iodine), biochemical indices, body composition, household food security, and clinical assessment of nutritional deficiencies, were not evaluated. Future studies should include these complementary measures and larger, more representative samples to provide a more comprehensive assessment of malnutrition among school-age children in Delta State.

CONCLUSION

The majority of school-age children in Delta State had normal nutritional status; however, thinness, stunting, and underweight remain important public health concerns. Gender and vegetable consumption were significantly associated with nutritional status, and female gender emerged as an independent protective factor against thinness. Sociodemographic and socioeconomic characteristics such as parental educational status, parental employment status, monthly income, and fruit consumption were not significantly associated with nutritional status. There is a need for school-based nutrition interventions, health education programmes, and policies aimed at improving dietary practices among school-age children.

ACKNOWLEDGEMENTS

Authors are thankful to everyone that supported this study in one way or the other to enable achieve the purpose of the research successfully.

References

26 sources

1 World Health Organization. Malnutrition Fact Sheet. Geneva, Switz WHO Available https//www.who.int/news-room/fact-sheets/detail/malnutrition. 2024;

2 Marume A, Kasanzu S, Chirenda J. Socio-economic and rural-urban disparities in the double burden of childhood malnutrition in sub-Saharan Africa. J Heal Popul Nutr [Internet]. 2025;44(1):335. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC12487389/

3 Black R, Victora C, Walker S, Bhutta Z, Christian P, De Onis M, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet [Internet]. 2013;382(9890):427–51. Available from: https://pubmed.ncbi.nlm.nih.gov/23746772/

4 Victora C, Christian P, Vidaletti L, Gatica-Domínguez G, Menon P, Black R. Revisiting maternal and child undernutrition in low-income and middle-income countries: variable progress towards an unfinished agenda. Lancet [Internet]. 2021;397(10282):1388–99. Available from: https://pubmed.ncbi.nlm.nih.gov/33691094/

5 Best C, Neufingerl N, van Geel L, van den Briel T, Osendarp S. The nutritional status of school-aged children: why should we care? Food Nutr Bull [Internet]. 2010;31(3):400–17. Available from: https://pubmed.ncbi.nlm.nih.gov/20973461/

6 United Nations Children's Fund. The State of the World's Children 2023: For Every Child, Nutrition. New York, NY UNICEF Available https//www.unicef.org/reports/state-worlds-children-2023. 2023;

7 Akseer N, Al-Gashm S, Mehta S, Mokdad A, Bhutta Z. Global and regional trends in the nutritional status of young people: a critical and neglected age group. Ann N Y Acad Sci [Internet]. 2017;1393(1):3–20. Available from: https://pubmed.ncbi.nlm.nih.gov/28436100/

8 National Population Commission (NPC) & ICF. Nigeria demographic and health survey 2018. Abuja, Niger NPC; Rockville, Maryland, USA ICF Available https//ngfrepository.org.ng8443/bitstream/123456789/3145/1/NDHS%202018.pdf. 2019;

9 Iheme G. The undernutrition situation of school-age children in Nigeria: A systematic review and meta-analysis. Curr Nutr Food Sci [Internet]. 2021;17(8):826–832. Available from: https://www.benthamdirect.com/content/journals/cnf/10.2174/1573401317666210216114311

10 Umeokonkwo A, Ibekwe M, Umeokonkwo C, Okike C, Ezeanosike O, Ibe B. Nutritional status of school age children in Abakaliki metropolis, Ebonyi State, Nigeria. BMC Pediatr [Internet]. 2020;20(1):114. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7060553/

11 Ayogu RNB, Afiaenyi IC, Madukwe EU, Udenta EA. Prevalence and predictors of under-nutrition among school children in a rural South-eastern Nigerian community: a cross sectional study. BioMed Cent Public Heal [Internet]. 2018;18:587–95. Available from: https://doi.org/10.1186/s12889-018-5479-5

12 Miller V, Yusuf S, Chow C, Dehghan M, Corsi D, Lock K, et al. Availability, affordability, and consumption of fruits and vegetables in 18 countries across income levels: findings from the Prospective Urban Rural Epidemiology (PURE) study. Lancet Glob Heal [Internet]. 2016;4(10):e695-703. Available from: https://pubmed.ncbi.nlm.nih.gov/27567348/

13 Atukunda P, Eide W, Kardel K, Iversen P, Westerberg A. Unlocking the potential for achievement of the UN Sustainable Development Goal 2 - "Zero Hunger" - in Africa: targets, strategies, synergies and challenges. Food Nutr Res [Internet]. 2021;26:65. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC8254460/

14 Moyegbone J, Nwose E, Nwajei S, Agege E, Odoko J, Igumbor E, et al. Identifying Landmark Achievements in Primary Eye Care Promotion in Nigeria in Accordance with Alma – Ata Declaration of 1978 : A Review. Ophthalmol Res An Int J. 2021;14(1):1–12.

15 Moyegbone J, Nwose E, Anowa E, Clarke A, Odoko J, Agege A. Prevalence of Visual Impairment among Primary and Secondary School Children in Delta State, Nigeria. J Niger Optom Assoc [Internet]. 2023;25(1):42–53. Available from: https://dx.doi.org/10.4314/jnoa.v25i1.7

16 Delta State. Primary Schools in Delta State. 2021; Available from: https://eduintelng.org/edu-stat/primary-schools-in-delta-state/

17 Delta State Ministry of Basic & Secondary Education. Schools List. Delta State [Internet]. 2022; Available from: https://deltastatemobse.net/SchoolsList.aspx

18 WHO. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. World Heal Organ Available https//iris.who.int/server/api/core/bitstreams/b82789de-df63-41ba-8058-25f9f5da0c40/content. 2011;

19 WHO Expert Committee on Physical Status. Physical status: the use and interpretation of anthropometry, report of a WHO expert committee. (WHO Technical Report Series, No. 854. World Heal Organ Geneva [Internet]. 1995; Available from: http://whqlibdoc.who.int/trs/WHO_TRS_854.pdf], accessed 20 May 2011

20 Kuczmarski R, Ogden C, Guo S, Grummer-Strawn L, Flegal K, Mei Z, et al. CDC 2000: Growth Charts for the United States: methods and development. Vital Heal Stat. 2002;11(246):1–190.

21 Waterlow I, Buzina R, Keller W, Lane I, Nichaman M, Anner I. The presentation and use of height and weight data for comparing the nutritional status of groups of children under the age of 10 years. Bull World Heal Organ. 1977;55:489–98.

22 Martínez-Castaneiras P, Ortiz C, Larrea-Baz N, Lope V, Sanchez-Gordon G, Ruiz-Moreno E, et al. Intake of fruit, vegetables and pulses, and all-cause, cardiovascular and cancer mortality: Results from a population-based prospective study. Public Health [Internet]. 2025;239:169–78. Available from: https://www.sciencedirect.com/science/article/pii/S0033350624005109

23 Senbanjo I, Oshikoya K, Odusanya O, Njokanma O. Prevalence of and risk factors for stunting among school children and adolescents in Abeokuta, southwest Nigeria. J Heal Popul Nutr [Internet]. 2011;29(4):364–70. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC3190367/

24 Wrottesley S, Mates E, Brennan E, Bijalwan V, Menezes R, Ray S, et al. Nutritional status of school-age children and adolescents in low- and middle-income countries across seven global regions: a synthesis of scoping reviews. Public Health Nutr [Internet]. 2023;26(1):63–95. Available from: https://pubmed.ncbi.nlm.nih.gov/35156607/

25 Beressa G, Feyissa G, Murimi M, Muhammed A, Abdulkadir A, Jema A, et al. Nutritional status and associated factors among school age children in Southeast Ethiopia using a bayesian analysis approach. Sci Rep [Internet]. 2025;15(1):24141. Available from: https://pubmed.ncbi.nlm.nih.gov/40619564/

26 Obasohan PE, Walters SJ, Jacques RM. The Risk Factors Associated with the Prevalence of Multimorbidity of Anaemia , Malaria , and Malnutrition among Children Aged 6 – 59 Months in Nigeria. Int J Environ Res Public Health [Internet]. 2024;21(6):765. Available from: https://www.mdpi.com/1660-4601/21/6/765

HOW TO CITE

John Esimaje Moyegbone, Ezekiel Uba Nwose. Malnutrition: Prevalence and Associated Factors among School Age Children in Delta State, Nigeria. *Delta Oghara Medical Journal*. 2026;2(1).

https://domj.org/index.php/start/article/view/malnutrition-prevalence-associated-factors-school-age-children-delta-state

Scan to view article

ORIGINAL ARTICLE OPEN ACCESS

Economic Burden AND Patterns of Noncommunicable Diseases in Rural Nigeria: A Cross-Sectional Study in Esan Central LGA, Edo State

Nosa Akpede[1], Mojeed Olaitan Rafiu[2], Kingsley Osuji[3], Francis Osemhoahu Erah[1], Musa Abdullahi Muhammed[1], Enahoro Prince[1], Ojeh-Oziegbe Oseyomon[4], George Obozokhale Akpede[5]

AFFILIATIONS

1 Department of Community Medicine, Faculty of Clinical Sciences, Ambrose Alli University, Ekpoma, Edo State and Department of Community Medicine, Irrua Specialist Teaching Hospital, Irrua, Edo State

2 Nephrology Unit, Department of Internal Medicine, Irrua Specialist Teaching Hospital, Irrua, Edo State and Department of Internal Medicine, Faculty of Clinical Sciences, Ambrose Alli University, Ekpoma, Edo State.

3 Department of Chemical Pathology, Faculty of Basic Clinical Sciences, Ambrose Alli University, Ekpoma, Edo State and Department of Chemical Pathology, Irrua Specialist Teaching Hospital, Irrua, Edo State

4 Department of Internal Medicine, Edo Specialist Hospital, Benin City, Edo State

5 Department of Paediatrics, Faculty of Clinical Sciences, Ambrose Alli University, Ekpoma, Edo State, and Department of Paediatrics, Irrua Specialist Teaching Hospital, Irrua, Edo State.

CORRESPONDING AUTHOR(S)

Correspondence 1: Dr Nosa Akpede
Department of Community Medicine, Faculty of Clinical Sciences, Ambrose Alli University, Ekpoma, Edo State and Department of Community Medicine, Irrua Specialist Teaching Hospital, Irrua, Edo State
nosaakpede1@gmail.com
08166339853

Correspondence 2: Dr Mojeed Olaitan Rafiu
Nephrology Unit, Department of Internal Medicine, Irrua Specialist Teaching Hospital, Irrua, Edo State and Department of Internal Medicine, Faculty of Clinical Sciences, Ambrose Alli University, Ekpoma, Edo State.
Orcid Number: 0000000162890967.
raphymoj2012@gmail.com
08033566001

ARTICLE HISTORY

Received 18/06/2026
Accepted 17/07/2026
Published 01/08/2026

ABSTRACT

Background:

Noncommunicable diseases (NCDs) are a growing global health crisis, accounting for nearly three-quarters of all deaths worldwide. In Nigeria, the burden of hypertension, diabetes, and other chronic conditions is rising rapidly, exacerbated by limited health insurance coverage, fragmented healthcare infrastructure, and high out-of-pocket costs. This study assessed the economic burden and healthcare utilisation patterns related to NCDs in a rural Nigerian setting.

Methods:

A descriptive cross-sectional study was conducted among 206 adults in Esan Central LGA, Edo State. Multistage sampling was used to select participants. Data on sociodemographics, NCD diagnoses, and direct healthcare costs were collected via structured questionnaires. Out-of-pocket expenses for consultations, medications, investigations, transportation, and hospital admissions were documented. Associations between age and NCD prevalence were tested using chi-square analysis.

Results:

Nearly one-third of respondents reported an NCD diagnosis, with hypertension and diabetes being the most prevalent. Age was significantly associated with a higher incidence of NCDs. Affected individuals faced multiple financial burdens across care categories, with medications and hospital admissions being the most expensive. Over 75% relied on personal funds for treatment, with minimal support from insurance or family.

Conclusion:

The study highlights the cumulative economic strain of NCD management in resource-limited settings, emphasising the urgent need for financial protection mechanisms. Policies expanding insurance coverage, subsidising essential care, and decentralising NCD services to primary care levels are crucial to reduce this burden and improve health equity in Nigeria.

Chronic disease management | Economic burden | Healthcare costs | Nigeria | Noncommunicable diseases

Noncommunicable diseases have emerged as one of the most pressing global health challenges of our time, accounting for an estimated 43 million deaths annually, approximately 75% of all mortality worldwide, according to World Health Organisation data.[1] The cardiovascular disease epidemic alone claims 17.9 million lives each year, with hypertension affecting about 1.28 billion adults globally, including over 550 million people who remain unaware of their condition.[2] This silent pandemic disproportionately burdens low- and middle-income countries, where health systems already strained by infectious diseases must now contend with the rising tide of chronic conditions.[1] Across Africa, noncommunicable diseases contribute to approximately 2.1 million deaths annually (37% of total mortality), with projections suggesting this figure will surpass communicable diseases by 2030.[3,4] The continent's 257 million hypertensive patients face particularly acute challenges, including limited healthcare infrastructure and medication shortages, with barely 5% to 10% of hypertensive individuals achieving blood pressure control.[5,6]

Nigeria, Africa's most populous nation with over 218 million people, mirrors this troubling trajectory. Recent epidemiological studies indicate that 30% of Nigerian adults - approximately 65.4 million people - live with hypertension, while diabetes prevalence has risen sharply to affect between 3-7% of the population (7-15 million individuals).[7,8] The economic consequences are severe, with many households spending over 30% of their income on chronic disease management, often resorting to catastrophic health expenditures that push families into poverty, further compounded by Nigeria's fragmented health system, where less than 5% of the population (about 11 million people) has meaningful health insurance coverage and essential medicines remain out of reach for most citizens.[9,10]

The growing crisis demands urgent attention as the human and economic costs mount, and the convergence of communicable and noncommunicable diseases threatens to overwhelm the nation's healthcare infrastructure unless immediate, coordinated action is taken to strengthen prevention, diagnosis and treatment capabilities at all levels of care.

This study aims to comprehensively assess the economic burden and healthcare utilisation patterns of noncommunicable diseases in Nigeria, with a particular focus on the management of hypertension and diabetes. By analysing treatment costs, access barriers, and socioeconomic impacts at both household and health system levels, we seek to identify key gaps in service delivery and financing mechanisms. Our findings will provide critical evidence to inform policy decisions aimed at strengthening primary care capacity, expanding financial protection schemes, and developing targeted interventions to reduce the growing burden of NCDs in resource-limited settings.

Materials and Methods

Study Area

This study was conducted in Esan Central Local Government Area (ECLGA) of Edo State, Nigeria, which has a population of 105,313 and comprises 10 political wards. The area hosts various health facilities, including the Irrua Specialist Teaching Hospital and multiple primary health centres. The study took place over five months, from October 2023 to February 2024.

Study Population

The study population included adults aged 18 years and above who had resided in ECLGA for at least one year and had accessed healthcare services at least once. Individuals who declined participation, were under 18, or were not residents were excluded.

Sampling Technique

A descriptive cross-sectional study design was adopted. A multistage sampling technique was used. Two wards (Otoruwo II and Ugbegun) were selected by simple random sampling. From each ward, one community and two quarters were randomly chosen. Cluster sampling was then used to select households. The sample size of 206 was determined using the Leslie Kish formula, based on a hypertension prevalence of 14.2%, with a 10% adjustment for non-response.

Data Collection and Analysis

Data were collected using a pretested, structured, interviewer-administered questionnaire divided into four sections: sociodemographics, awareness of non-communicable diseases (NCDs), direct healthcare costs, and cost patterns. The researcher and a trained assistant collected data. Entries were managed and analysed using SPSS version 20. Descriptive statistics (frequencies, percentages) were used to summarise variables. Associations between variables were tested at a 5% significance level. Out-of-pocket expenses were defined as direct payments for consultations, medications, investigations, and transportation.

Ethical Consideration

Ethical approval was obtained from the Irrua Specialist Teaching Hospital Ethics Committee. Participation was voluntary, and informed consent was obtained after explaining the study's purpose, risks, and benefits. Anonymity was maintained by coding responses to prevent identification. Institutional approval was also granted by the Department of Community Medicine, Ambrose Alli University, Ekpoma.

RESULTS

Sociodemographic Characteristics of Respondents (Table 1)

The majority of respondents were younger than 40 years (132; 64.1%), while only 6 (2.9%) were aged 65 years or older. Females accounted for 118 (57.3%) of the participants, slightly exceeding the number of males. Most respondents were married (129; 62.6%), and a vast majority identified as Christians (179; 86.9%).

Regarding education, secondary schooling was the most commonly attained level (100; 48.5%), while 65 (31.6%) had no formal education. Monthly income was below ₦30,000 for over half the participants, with 45 (21.8%) earning less than ₦10,000. The predominant household size was 1–4 members (116; 56.3%), with only 9.7% living in households of more than 8 members.

Table 1: Sociodemographic Characteristics of Respondents.

Variable	Frequency (n=206)	Percentage (%)
Age Group (years)		
< 40	132	64.1
40–64	68	33.0
≥ 65	6	2.9
Sex		
Male	88	42.7
Female	118	57.3
Marital Status		
Single	49	23.8
Married	129	62.6
Divorced	26	12.6
Widowed	2	1.0
Religion		
Christianity	179	86.9
Islam	19	9.2
Others	8	3.9
Level of Education		
No formal education	65	31.6
Primary	16	7.8
Secondary	100	48.5
Tertiary	25	12.1
Monthly Income (₦)		
< 10,000	45	21.8
10,001–30,000	78	37.9
30,001–50,000	31	15.0
> 50,000	31	15.0
Household Size		
1–4	116	56.3
5–8	70	34.0
>8	20	9.7

Diagnosis of Non-Communicable Diseases Among Respondents (Figure 1)

Among the respondents, hypertension was the most commonly reported condition, with 29 (14.1%) individuals confirming a diagnosis. Diabetes mellitus followed closely, affecting 27 (13.1%) of participants, while arthritis was reported by 26 (12.6%). Fewer cases were noted for asthma (12; 5.8%) and cancer (7; 3.4%).

Mental health and neurological conditions were far less prevalent: only 3 respondents each (1.5%) reported being diagnosed with depression or osteoporosis, and single cases were recorded for epilepsy (0.5%), Alzheimer's disease (0.5%), and schizophrenia (0.5%).

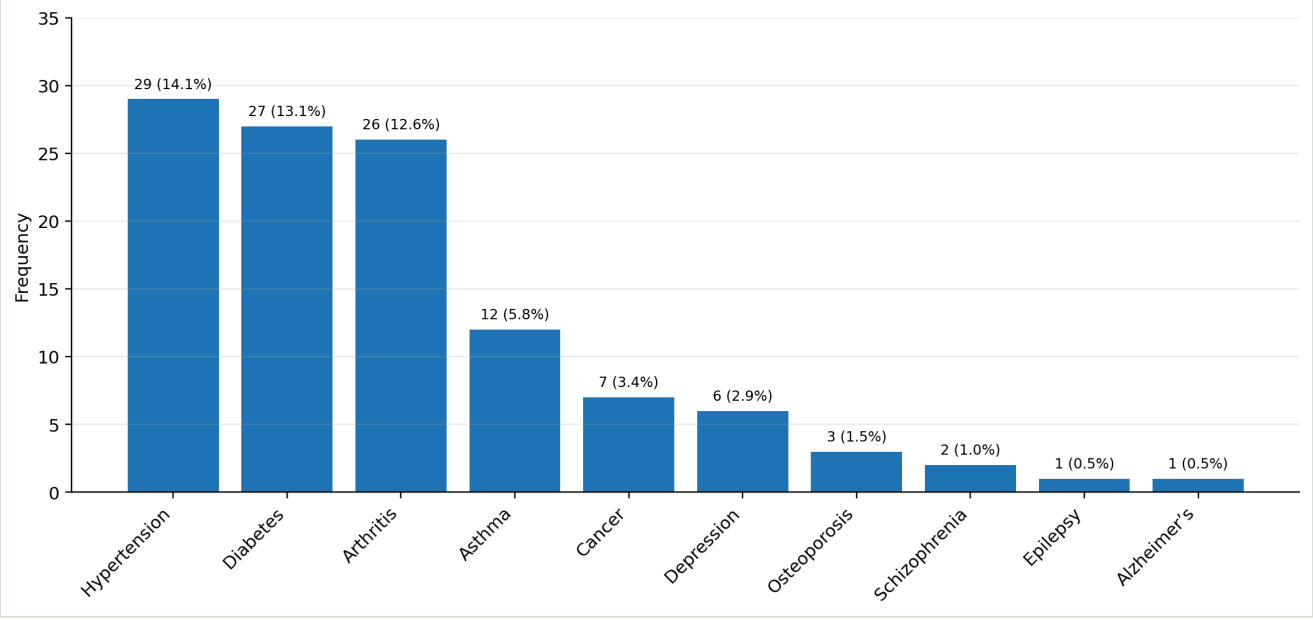

Figure 1: Diagnoses of non-communicable diseases among respondents

Pattern of Direct Costs Among Respondents with Non-Communicable Diseases (Table 2)

Out of 206 respondents, 61 (29.6%) reported being diagnosed with a non-communicable disease. Among these, the majority spent less than ₦10,000 ($13) on consultation (46; 75.4%), while hospital admission costs were more varied, with 24 (39.3%) spending between ₦10,000 and ₦19,999 ($13 - $26), and 19 (31.2%) paying between ₦20,000 and ₦29,999 ($26 - $39).

Over half of the participants (32; 52.4%) spent less than ₦10,000 ($13) on laboratory investigations, though a similar portion (41.0%) fell into the ₦10,000–₦19,999 ($13 - $26) range. For medication, 25 (41.0%) reported costs between ₦10,000 and ₦19,999 ($13 - $26), while another 17 (27.9%) spent between ₦20,000 and ₦29,999 ($26

- $39). Transportation costs were low for most respondents, with 44 (72.1%) spending under ₦10,000 ($13).

In terms of financing, 60 (77.9%) of the individuals with NCDs paid for their care out-of-pocket. Only a small fraction received financial support from family (15; 19.5%) or relatives (2; 2.6%), suggesting a significant economic burden borne by affected individuals.

Table 2: Pattern of Direct Costs Among Respondents with Non-Communicable Diseases

Variable	Frequency (n = 61)	Percentage (%)
Diagnosed with NCD (n=206)		
Yes	61	29.6
No	145	70.4
Consultation Cost (₦)		
< 10,000 ($13)	46	75.4
10,000–19,999 ($13 – $26)	13	21.4
20,000–29,999 ($26 - $39)	1	1.6
≥ 30,000 ($39)	1	1.6
Hospital Admission (₦)		
< 10,000 ($13)	18	29.5
10,000–19,999 ($13 - $26)	24	39.3
20,000–29,999 ($26 - $39)	19	31.2
≥ 30,000 ($39)	0	0.0
Laboratory Investigation (₦)		
< 10,000 ($13)	32	52.4
10,000–19,999 ($13 - $26)	25	41.0
20,000–29,999 ($26 -$39)	2	3.3
≥ 30,000 ($39)	2	3.3
Medication (₦)		
< 10,000 ($13)	16	26.2
10,000–19,999 ($13 - $26)	25	41.0
20,000–29,999 ($26 - $39)	17	27.9
≥ 30,000 ($39)	3	4.9
Transportation (₦)		
< 10,000 ($13)	44	72.1
10,000–19,999 ($13 - $26)	12	19.7
20,000–29,999 ($26 - $39)	4	6.6
≥ 30,000 ($39)	1	1.6
Source of financing		
Self	60	77.9
Family	15	19.5
Relatives	2	2.6

Association Between Age Group and Non-Communicable Diseases Among Respondents (Table 3)

There was a statistically significant association between age group and diabetes mellitus ($\chi^2 = 41.896$; $p < 0.001$), with prevalence highest among those aged 40–64 years (37.3%). Hypertension also increased with age and showed a significant association ($\chi^2 = 16.144$; $p < 0.001$), affecting 29.9% of those aged 40–64 years and 28.6% of those ≥65 years.

For asthma, although prevalence was slightly higher among older respondents, the association with age was not statistically significant ($\chi^2 = 4.711$; $p = 0.095$). Conversely, arthritis showed a strong age-related trend, with 31.3% of respondents aged 40–64 years affected, and a significant association observed ($\chi^2 = 25.364$; $p < 0.001$).

Table 3: Association Between Age Group and Selected NCDs Among Respondents (n = 206).

Disease	Age (years)	Yes (%)	No (%)
Diabetes Mellitus	< 40	4 (3.0%)	128 (97.0%)
	40–64	25 (37.3%)	42 (62.7%)
	≥ 65	2 (28.6%)	5 (71.4%)
		$\chi^2 = 41.896$; df = 2	$p < 0.001$*
Hypertension	< 40	11 (8.3%)	121 (91.7%)
	40–64	20 (29.9%)	47 (70.1%)
	≥ 65	2 (28.6%)	5 (71.4%)
		$\chi^2 = 16.144$; df = 2	$p < 0.001$*
Asthma	< 40	7 (5.3%)	125 (94.7%)
	40–64	9 (13.4%)	58 (86.6%)
	≥ 65	0 (0.0%)	7 (100.0%)
		$\chi^2 = 4.711$; df = 2	p = 0.095
Arthritis	< 40	7 (5.3%)	125 (94.7%)
	40–64	21 (31.3%)	46 (68.7%)
	≥ 65	2 (28.6%)	5 (71.4%)
		$\chi^2 = 25.364$; df = 2	$p < 0.001$*

DISCUSSION

Nearly one in three respondents reported a confirmed diagnosis of an NCD, with hypertension and diabetes being the most common. This trend mirrors national patterns, where hypertension affects approximately 38% of adults and diabetes prevalence continues to rise.[11,12] A similar burden has been reported in other low- and middle-income countries (LMICs), including a recent study in Ghana, which found NCD prevalence rates exceeding 25% among adults.[13] The prevalence of diabetes mellitus and hypertension was highest in the middle age group in this study. This may reflect the growing

adoption of Westernised diets and sedentary lifestyles, combined with inadequate preventive healthcare systems.[11,12] This trajectory, if unaddressed, could lead to a sustained rise in NCD-related morbidity and healthcare expenditure.

Our observation in this study reflected that age was a significant determinant of disease distribution in this population, with respondents aged 40 and above bearing the greatest burden of diabetes, hypertension, and arthritis. This age-dependent pattern is consistent with findings from studies in Kenya and India, where older adults were disproportionately affected by NCDs.[14,15] One possible explanation is the cumulative exposure to predisposing factors such as poor dietary habits, physical inactivity, and untreated elevated blood pressure over time. However, the higher prevalence of NCDs in the middle-aged group in our study and earlier studies suggests that predisposing factors may be taking hold earlier in life, possibly due to changing social and environmental determinants. Predisposing factors to NCDs are usually already established for some years before the clinical occurrence of NCDs. This observation makes it necessary to integrate routine screening for NCDs into primary care, particularly for adults well before the age of 40 years, to facilitate early diagnosis and intervention.

The financial toll of NCD care was evident in the multiple categories of out-of-pocket spending reported by affected individuals. Respondents consistently paid for consultation fees, medications, diagnostic investigations, transportation, and, in some cases, hospital admissions, each contributing cumulatively to a significant economic strain. Particularly concerning is the disproportionately high cost of medications and hospital admissions, with many respondents spending over ₦20,000 ($26) per service. When combined with other routine expenses such as transportation and laboratory testing, the total cost of managing a chronic condition becomes unsustainable for low-income households. This layered pattern of expenditure accentuates the absence of financial protection mechanisms and highlights the vulnerability of patients who must navigate an underfunded health system while simultaneously shouldering the burden of lifelong treatment. Comprehensive reforms aimed at reducing or subsidising these cumulative costs, through expanded insurance coverage, community drug schemes, and investment in local diagnostic capacity, are critical to improving NCD outcomes and preventing catastrophic health expenditure.

The heavy reliance on personal funds to finance healthcare, reported by over three-quarters of respondents with NCDs, further illustrates the absence of institutional safety nets. This is consistent with findings from other Nigerian studies where over 90% of patients paid for healthcare out-of-pocket.[10,16] The near-complete absence of formal health insurance in this cohort is alarming and reflects the broader national reality, where less than 5% of the population is enrolled in any health insurance scheme. The public health implications of such an arrangement are profound: individuals with chronic illnesses may delay or abandon care altogether due to cost, leading to avoidable complications, hospitalisations, and loss of productivity. Policy reforms are urgently needed to improve enrollment in the National Health Insurance Scheme (NHIS), expand benefit packages to cover NCDs, and subsidise essential medicines for chronic diseases.

Transportation costs were an overlooked but significant component of total healthcare expenditure, with most respondents spending out-of-pocket for travel to health facilities. In rural areas like Esan Central, where primary healthcare infrastructure is limited, patients often travel long distances to obtain care. This barrier has been documented in other sub-Saharan African contexts, where transportation costs are a key determinant of healthcare-seeking behaviour.[17,18] The cumulative cost of accessing decentralised services, especially for conditions requiring regular follow-up such as diabetes and hypertension, may discourage adherence to treatment regimens. There is therefore a critical need to strengthen community-level care through mobile outreach clinics and decentralisation of essential NCD services to primary health centres.

Limitations of this study include recall bias, which may have influenced responses, especially regarding healthcare expenditures. To reduce this, questions were restricted to events occurring within the past 6 to 24 months. Additionally, self-reported data may have introduced subjective errors.

Conclusion

This study underscores the urgent need for a systems-based response to the growing burden of non-communicable diseases in Nigeria. Beyond individual healthcare costs, the wider societal impacts, such as loss of productivity and increased health system strain, demand coordinated, multisectoral action. Strengthening early detection, reducing out-of-pocket treatment costs, and expanding access through universal health coverage are critical steps. Without sustained investment in NCD prevention and care, communities like Esan Central risk remaining locked in cycles of illness and economic hardship.

References

18 sources

1 World Health Organisation. Noncommunicable diseases. Accessed July 11, 2025. https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

2 World Health Organisation. Hypertension. Accessed July 11, 2025. https://www.who.int/news-room/fact-sheets/detail/hypertension

3 Chikowore T, Kamiza AB, Oduaran OH, Machipisa T, Fatumo S. Non-communicable diseases pandemic and precision medicine: Is Africa ready? EBioMedicine. 2021;65:103260. doi:10.1016/J.EBIOM.2021.103260

4 Müller SA, Elimian K, Rafamatanantsoa JF, Reichert F, Mosala F, Böff L, Touré SF, Boone I, Ravaoarisoa L, Nduenga S, Ortu G, Pozo-Martin F, Tomczyk S, Eckmanns T, Okwor T, Akoua-Koffi C, Diané B, Randriamanantany ZA, Ahuka S, Ochu CL, El-Bcheraoui C. The burden and treatment of non-communicable diseases among healthcare workers in sub-Saharan Africa: a multi-country cross-sectional study. Front Public Health. 2024;12:1375221. doi:10.3389/FPUBH.2024.1375221

5 Bayaraa N, Azahar NM, Kitaoka K, Kobayashi Y, Yano Y. African Control of Hypertension through Innovative Epidemiology and a Vibrant Ecosystem (ACHIEVE): a holistic approach for hypertension control in Africa. J Hum Hypertens. 2025;39(2):83-85. doi:10.1038/S41371-023-00845-7;SUBJMETA=243,692,699,700,75;KWRD=HEALTH+CARE,HYPERTENSION

6 Low awareness and control hamper hypertension fight in Africa | WHO | Regional Office for Africa. Accessed July 11, 2025. https://www.afro.who.int/news/low-awareness-and-control-hamper-hypertension-fight-africa

7 Adeloye D, Owolabi EO, Ojji DB, Auta A, Dewan MT, Olanrewaju TO, Ogah OS, Omoyele C, Ezeigwe N, Mpazanje RG, Gadanya MA, Agogo E, Alemu W, Adebiyi AO, Harhay MO. Prevalence, awareness, treatment, and control of hypertension in Nigeria in 1995 and 2020: A systematic analysis of current evidence. The Journal of Clinical Hypertension. 2021;23(5):963. doi:10.1111/JCH.14220

8 Olamoyegun MA, Alare K, Afolabi SA, Aderinto N, Adeyemi T. A systematic review and meta-analysis of the prevalence and risk factors of type 2 diabetes mellitus in Nigeria. Clin Diabetes Endocrinol. 2024;10(1):1-13. doi:10.1186/S40842-024-00209-1/FIGURES/7

9 Eze OI, Iseolorunkanmi A, Adeloye D. The National Health Insurance Scheme (NHIS) in Nigeria: current issues and implementation challenges. Journal of Global Health Economics and Policy. 2024;4:e2024002. doi:10.52872/001C.120197

10 Aregbeshola BS, Khan SM. Out-of-Pocket Payments, Catastrophic Health Expenditure and Poverty Among Households in Nigeria 2010. Int J Health Policy Manag. 2018;7(9):798. doi:10.15171/IJHPM.2018.19

11 Uloko AE, Musa BM, Ramalan MA, Gezawa ID, Puepet FH, Uloko AT, Borodo MM, Sada KB. Prevalence and Risk Factors for Diabetes Mellitus in Nigeria: A Systematic Review and Meta-Analysis. Diabetes Therapy. 2018;9(3):1307-1316. doi:10.1007/s13300-018-0441-1

12 Adeke AS, Chori BS, Neupane D, Sharman JE, Odili AN. Socio-demographic and lifestyle factors associated with hypertension in Nigeria: results from a country-wide survey. J Hum Hypertens. 2024;38(4):365-370. doi:10.1038/S41371-022-00673-1;SUBJMETA=243,459,692,699,700,75;KWRD=DISEASE+PREVENTION,HYPERTENSION

13 Boakye H, Atabila A, Hinneh T, Ackah M, Ojo-Benys F, Bello AI. The prevalence and determinants of non-communicable diseases among Ghanaian adults: A survey at a secondary healthcare level. PLoS One. 2023;18(2):e0281310. doi:10.1371/JOURNAL.PONE.0281310

14 Chauhan S, Kumar S, Patel R, Simon DJ, Kumari A. Burden of communicable and non-communicable diseases-related inequalities among older adults in India: a study based on LASI survey. BMC Geriatr. 2022;22(1):790. doi:10.1186/S12877-022-03481-X

15 Okyere J, Ayebeng C, Dickson KS. Burden of non-communicable diseases among women of reproductive age in Kenya: A cross-sectional study. BMJ Open. 2024;14(7). doi:10.1136/BMJOPEN-2023-078666

16 Awoyemi BO, Makanju AA, Mpapalika J, Ekpeyo RS. A time series analysis of government expenditure and health outcomes in Nigeria. J Public Health Afr. 2023;14(7):1409. doi:10.4081/JPHIA.2023.1409

17 Sarkodie K, Poku AA, Gyabaah KOY, Damte FK, Boakye DS, Ansah P. Influencing factors of place and healthcare seeking behaviour of pregnant women accessing care at a herbal clinic in Ghana. Adv Integr Med. 2025;12(2):100491. doi:10.1016/J.AIMED.2025.100491

18 Chilot D, Shitu K, Gela YY, Getnet M, Mulat B, Diress M, Belay DG. Factors associated with healthcare-seeking behaviour for symptomatic acute respiratory infection among children in East Africa: a cross-sectional study. BMC Pediatr. 2022;22(1):1-10. doi:10.1186/S12887-022-03680-W/TABLES/3

HOW TO CITE

Nosa Akpede, Mojeed Olaitan Rafiu, Kingsley Osuji, Francis Osemhoahu Erah, Musa Abdullahi Muhammed, Enahoro Prince, Ojeh-Oziegbe Oseyomon, George Obozokhale Akpede. Economic Burden AND Patterns of Noncommunicable Diseases in Rural Nigeria: A Cross-Sectional Study in Esan Central LGA, Edo State. *Delta Oghara Medical Journal*. 2026;2(1).

https://domj.org/index.php/start/article/view/economic-burden-patterns-noncommunicable-diseases-rural-nigeria-cross-sectional-esan-central-lga

Scan to view article

ORIGINAL ARTICLE OPEN ACCESS

KNOWLEDGE, AWARENESS, AND RISK ASSESSMENT OF LASSA FEVER AMONG RESIDENTS OF ESAN WEST LOCAL GOVERNMENT AREA, EDO STATE, NIGERIA

Nosa Akpede[1], Mojeed Olaitan Rafiu[2], Kingsley Osuji[3], Francis Osemhoahu Erah[1], George Obozokhale Akpede[4], Danny Akhere Asogun[1]

AFFILIATIONS

1 Department of Community Medicine, Faculty of Clinical Sciences, Ambrose Alli University, Ekpoma, Edo State and Department of Community Medicine, Irrua Specialist Teaching Hospital, Irrua, Edo State.

2 Nephrology Unit, Department of Internal Medicine, Irrua Specialist Teaching Hospital, Irrua, Edo State and Department of Medicine, Faculty of Clinical Sciences, Ambrose Alli University, Ekpoma, Edo State.

3 Department of Chemical Pathology, Faculty of Basic Clinical Sciences, Ambrose Alli University, Ekpoma, Edo State and Department of Chemical Pathology, Irrua Specialist Teaching Hospital, Irrua, Edo State

4 Department of Paediatrics, Faculty of Clinical Sciences, Ambrose Alli University, Ekpoma, Edo State, and Department of Paediatrics, Irrua Specialist Teaching Hospital, Irrua, Edo State.

CORRESPONDING AUTHOR(S)

Dr Nosa Akpede, Department of Community Health, Irrua Specialist Teaching Hospital, PMB 08, Irrua, Edo State, Nigeria.
nosaakpede1@gmail.com

Dr Mojeed Olaitan Rafiu, Department of Internal Medicine, Irrua Specialist Teaching Hospital, PMB 08, Irrua, Edo State, Nigeria.
raphymoj2012@gmail.com
ORCID: 0000000162890967

ARTICLE HISTORY

Received 18/06/2026
Accepted 16/07/2026
Published 01/08/2026

ABSTRACT

Background:

Lassa fever is endemic in Esan West Local Government Area (LGA), Edo State, Nigeria, yet community-level data on awareness, knowledge, and behavioural risk remain scarce. This study assessed the awareness, knowledge, and risk level of Lassa fever among residents of Esan West LGA and identified their sociodemographic determinants.

Materials and Methods:

A descriptive cross-sectional study was conducted among 300 residents selected across all 10 wards of Esan West LGA between July and December 2013. Multi-stage sampling was employed. Knowledge was assessed using a 28-item scale and graded as good (≥75%), fair (50–74%), or poor (<50%). Risk level was assessed using a 20-item scale and graded as high (>75%), moderate (50–74%), or low (<50%). Chi-square test was used to evaluate associations between outcomes and sociodemographic characteristics at a significance level of 0.05. SPSS version 25 was used to analyse all data.

Results:

The mean age of respondents was 43.6 ± 21.6 years. Awareness of Lassa fever was recorded in 44.0% of respondents, with the ISTH Outreach Team and electronic media as the leading information sources. Only 7.0% had good knowledge, while 33.7% had poor knowledge. Educational level was the sole significant predictor of both awareness ($\chi^2 = 11.14$, $p = 0.011$) and knowledge ($\chi^2 = 19.8$, $p = 0.011$). High behavioural risk was identified in 37.0% of respondents. Female gender, employment in skilled and unskilled occupations, community of residence, and longer duration of stay were significant determinants of high risk ($p < 0.05$ to $p < 0.001$).

Conclusion:

Awareness and good knowledge of Lassa fever were low among residents of Esan West LGA. We recommend a shift from passive information delivery to peer-driven, structural, and incentivised interventions that embed health education into daily survival and cultural routines.

Lassa fever awareness knowledge risk assessment

Lassa fever is an acute viral haemorrhagic fever caused by the Lassa virus, a member of the Arenaviridae family, first described in 1969 in Borno State, Nigeria.[1] The disease accounts for an estimated 300,000 to 500,000 cases and 5,000 to 10,000 deaths annually across West Africa, with an at-risk population of approximately 59 million people spanning Nigeria, Sierra Leone, and Guinea.[2,3] Nigeria bears a disproportionate share of this burden, and Edo State consistently ranks among the most affected states in the country, with Esan West Local Government Area (LGA) recognised as one of its endemic zones.[4,5]

Transmission occurs primarily through contact with excretions of the multimammate rat (*Mastomys natalensis*), the principal reservoir host, and through direct contact of broken skin or mucous membranes with infected blood or body fluids.[6] Person-to-person transmission, including nosocomial spread, has been well documented, and control of the disease is compounded by the diagnostic non-specificity of its early clinical presentation, the absence of a licensed vaccine, and limitations in health worker capacity at the primary care level.[7,8] In the absence of effective biomedical countermeasures, community-level knowledge of transmission routes, recognition of risk behaviours, and adherence to preventive practices remain the most accessible and actionable targets for public health intervention.

Despite the endemicity of Lassa fever in Esan West LGA and its surrounding communities, population-level data on awareness, knowledge, and behavioural risk have remained limited. Available evidence from comparable West African settings, including Sierra Leone and Liberia, consistently reports low community awareness and persistent high-risk behaviours, suggesting that disease endemicity does not translate into adequate health literacy.[9,10] Within Nigeria, studies among caregivers in Edo State have reported moderate knowledge levels, but below what would be expected given occupational exposure, raising further concern about the adequacy of community-level understanding. [11,12]

Understanding the specific gaps in awareness and knowledge, and identifying the sociodemographic determinants of behavioural risk, is essential for designing targeted and context-appropriate interventions. This study therefore reports the awareness, knowledge, and risk assessment findings among residents of Esan West LGA to provide an empirical basis for community-directed Lassa fever control efforts in this endemic area.

MATERIALS AND METHODS

Study area

Esan West Local Government Area (LGA) is located in Edo State, Nigeria, with a projected population of 147,655 and administrative headquarters at Ekpoma. The LGA is organised into 10 wards spanning both semi-urban and rural communities. Environmental conditions in the area, including mud housing construction, open-air grain drying, and the practice of bush burning, are conducive to commensal rodent activity and facilitate sustained contact between residents and the *Mastomys natalensis* reservoir host. The Institute of Viral and Emergent Pathogens Control and Research (IVEPCR), located at the Irrua Specialist Teaching Hospital (ISTH) in the adjoining Esan Central LGA, serves as the regional reference centre for Lassa fever diagnosis and surveillance.

Study design and sampling technique

A descriptive cross-sectional study was conducted among residents of Esan West LGA over a 6-month interval. Multi-stage sampling was employed. In the first stage, the 10 wards of the LGA were enumerated, and respondents were allocated proportionally across all wards based on ward population size. In the second stage, where a ward comprised more than one community, a single community was selected by simple random sampling. In the third stage, households within each selected community were identified using the World Health Organisation Expanded Programme on Immunisation (WHO EPI) cluster sampling method, and eligible respondents were recruited from selected households.

Study population and selection criteria

The target population comprised permanent residents of Esan West LGA. Individuals were eligible for inclusion if they were aged five years or older, had resided in the LGA for at least six months preceding the study, and provided written informed consent. Individuals who were critically ill or unable to communicate were excluded.

Sample size determination

The minimum sample size was calculated using the Fisher formula: $n = Z^2pq/d^2$, where Z = 1.96 (at 95% confidence), p = 0.21 (prior Lassa fever seropositivity rate in the study area),[13] $q = 1 - p = 0.79$, and d = 0.05 (margin of error). This yielded a minimum of 255, which was adjusted upward using a design effect correction to 280, and further rounded to 300 to account for potential non-response.

Data collection and measurement

Data were collected using a structured interviewer-administered questionnaire developed by the investigators. The instrument captured sociodemographic characteristics, awareness of Lassa fever, and sources of information. The questionnaire was pretested among 50 residents of Etsako West LGA, a non-study area with comparable characteristics, and necessary revisions were made before deployment.

Data analysis

Data were entered and analysed using IBM SPSS Statistics version 25.0. Frequencies and percentages were computed for categorical variables. Associations between sociodemographic characteristics and the outcome variables of awareness, knowledge grade, and risk level were assessed using the Pearson chi-square test at a significance level of 0.05. Fisher's exact test was applied where any expected cell frequency was less than five.

Ethical considerations

Ethical approval for this study was obtained from the Research Ethics Committee of the Irrua Specialist Teaching Hospital. Written informed consent was obtained from all adult participants before enrolment. For participants below the age of 18 years, written consent was obtained from a parent or legal guardian, with assent obtained from the participant where applicable. Participation was entirely voluntary, and confidentiality of all data was maintained throughout.

RESULTS

Sociodemographic Characteristics of Respondents (Table 1, Figure 1)

A total of 300 respondents participated. The mean age was 43.6 ± 21.6 years. The largest age group was 21 to 40 years (111, 37.0%), followed by 41 to 60 years (79, 26.3%), over 60 years (69, 23.0%), 20 years and below (41, 13.7%). The sex distribution was nearly equal: 153 females (51.0%) and 147 males (49.0%). Three-quarters (75.7%) had at least a primary education, while 23.3% had no formal education. Most respondents were Christian (97.7%), Esan (94.0%), in unskilled occupations (66.7%), and married (64.0%). About three-fifths (59.7%) were from Ekpoma communities. The mean (SD)

duration of residence was 24.8 (2.6) years; 80.0% had been resident for at least 6 years.

Table 1: Sociodemographic characteristics of respondents (N = 300)

Characteristic	Frequency (N = 300)	Percentage (%)
Age group (years)		
≤20	41	13.7
21 to 40	111	37.0
41 to 60	79	26.3
>60	69	23.0
Sex		
Male	147	49.0
Female	153	51.0
Educational status		
None	70	23.3
Primary	90	30.0
Secondary	90	30.0
Tertiary	50	16.7
Occupation		
Unemployed	48	16.0
Unskilled	200	66.7
Skilled	52	17.3
Religion		
Christianity	293	97.7
Islam and African Traditional	7	2.3
Tribe		
Esan	282	94.0
Other Edo	3	1.0
Deltan	3	1.0
Others	12	4.0
Marital status		
Married	192	64.0
Single	95	31.7
Widowed, divorced or separated	13	4.3
Community		
Ogua	20	6.7
Ujogba	15	5.0
Ukhun	20	6.7
Ebhuoakhua	65	21.7
Ihumudumu	32	10.7
Iruekpen	34	11.3
Ujoelen	48	16.0
Urohi	13	4.3
Ehianle	35	11.7
Illeh	18	6.0
Duration of stay (years)		
1 to 5	60	20.0
6 to 10	122	40.7
More than 10	118	39.3

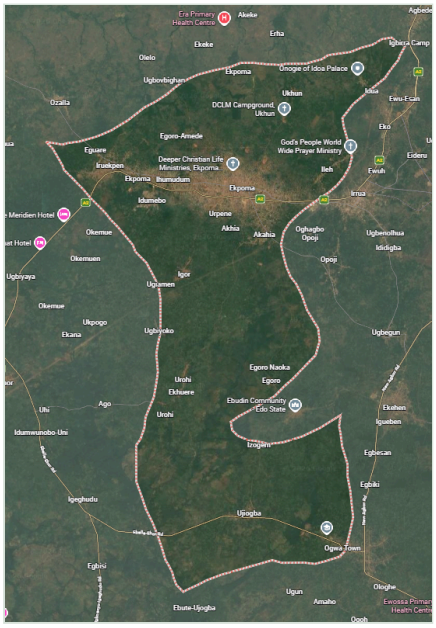

Figure 1. Map of Esan West LGA, Edo State

Awareness of Lassa Fever and Sources of Information (Table 2, Figure 2)

One hundred and thirty-two respondents (44.0%) were aware of Lassa fever, while 168 (56.0%) were not. Among those aware, the ISTH Outreach Team was the most common source (21.4%), followed by radio (20.2%), television (19.6%), and other health workers (14.9%). Print media was the least cited source (1.8%). Other sources included schools (5.5%), friends (4.2%), hospitals (3.6%), and churches (1.2%). Awareness was significantly associated with educational level (χ^2 = 11.14, p = 0.011) and occupation (χ^2 = 15.05, p = 0.001). No significant association was found with age group (χ^2 = 0.01, p >0.999), sex (χ^2 = 2.07, p = 0.150), community type (χ^2 = 0.00, p >0.999), duration of stay (χ^2 = 5.85, p = 0.054), or marital status (χ^2 = 1.44, p = 0.487).

Table 2: Awareness of Lassa fever by sociodemographic characteristics of respondents

Variable	Aware N (%)	Not Aware N (%)	Total	p-value / χ^2
Age group (years)				
≤20	18 (43.9)	23 (56.1)	41	
21 to 40	49 (44.1)	62 (55.9)	111	
41 to 60	35 (44.3)	44 (55.7)	79	
>60	30 (43.5)	39 (56.5)	69	>0.999 / 0.01
Sex				
Male	58 (39.5)	89 (60.5)	147	
Female	74 (48.4)	79 (51.6)	153	0.150 / 2.07
Educational level				
None	22 (31.4)	48 (68.6)	70	
Primary	36 (40.0)	54 (60.0)	90	
Secondary	44 (48.9)	46 (51.1)	90	
Tertiary	30 (60.0)	20 (40.0)	50	0.011* / 11.14
Occupation				
Unemployed	12 (25.0)	36 (75.0)	48	
Unskilled	87 (43.5)	113 (56.5)	200	
Skilled	33 (63.5)	19 (36.5)	52	0.001** / 15.05
Community type				
Semi-urban (Ekpoma)	79 (44.1)	100 (55.9)	179	
Rural villages	53 (43.8)	68 (56.2)	121	>0.999 / 0.001
Duration of stay (years)				
1 to 5	20 (33.3)	40 (66.7)	60	
6 to 10	51 (41.8)	71 (58.2)	122	
More than 10	61 (51.7)	57 (48.3)	118	0.054 / 5.85
Marital status				
Married	89 (46.4)	103 (53.6)	192	
Single	37 (38.9)	58 (61.1)	95	
Widowed, divorced or separated	6 (46.2)	7 (53.8)	13	0.487 / 1.44

Percentages add across rows. * p < 0.05.

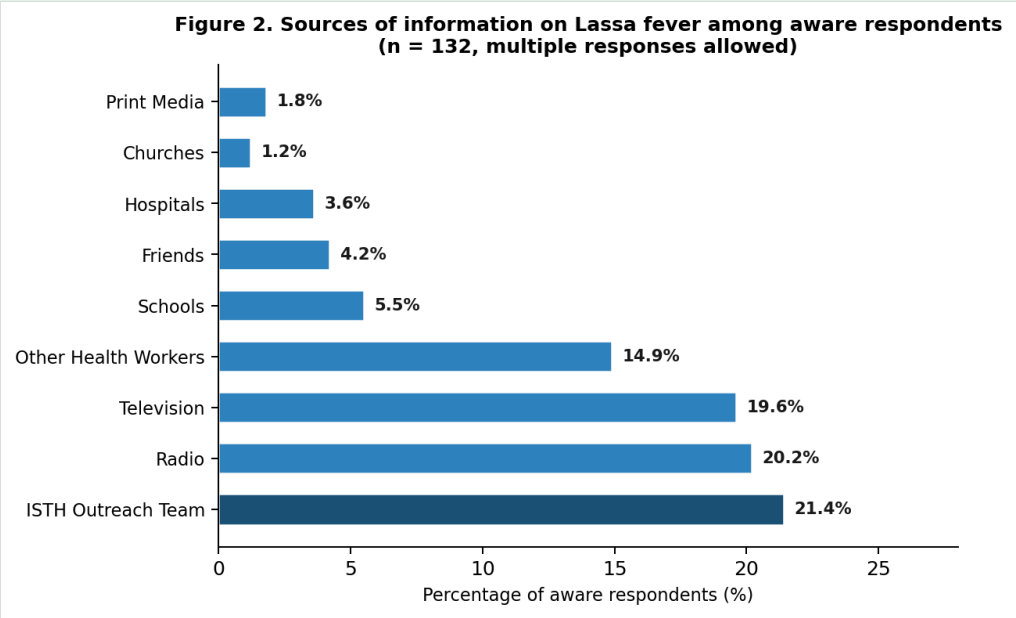

Figure 2. Sources of information on Lassa fever among aware respondents (n = 132, multiple responses allowed)

Knowledge of Lassa Fever (Table 3, Figure 3)

Overall, 21 respondents (7.0%) had good knowledge, 178 (59.3%) had fair knowledge, and 101 (33.7%) had poor knowledge. Educational level was the only significantly associated variable (χ^2 = 19.8, p = 0.011): the proportion with good knowledge rose from 4.2% (no education) to 5.6% (primary), 8.9% (secondary), and 10.0% (tertiary). The relationship of knowledge of Lassa fever with occupation approached significance (χ^2 = 8.08, p = 0.080), with skilled workers having the highest rate of good knowledge (15.4%). Age group (χ^2 = 3.37, p = 0.762), sex (χ^2 = 2.23, p = 0.327), religion (p = 0.893), marital status (p = 0.362), community (χ^2 = 9.26, p = 0.953), and duration of stay (χ^2 = 7.94, p = 0.094) were not significantly associated.

Table 3: Knowledge of Lassa fever by sociodemographic characteristics of respondents

Variable	Poor N (%)	Fair N (%)	Good N (%)	p-value / χ^2
Age group (years)				
≤20	14 (34.1)	23 (56.1)	4 (9.8)	
21 to 40	41 (36.9)	61 (55.0)	9 (8.1)	
41 to 60	25 (31.6)	51 (64.6)	3 (3.8)	
>60	21 (30.4)	43 (62.3)	5 (7.2)	0.762 / 3.37
Sex				
Female	46 (31.3)	93 (63.3)	8 (5.4)	
Male	55 (36.4)	85 (56.3)	13 (8.6)	0.327 / 2.23
Educational level				
None	24 (34.3)	43 (61.4)	3 (4.2)	
Primary	37 (41.1)	48 (53.3)	5 (5.6)	
Secondary	25 (27.8)	57 (63.3)	8 (8.9)	
Tertiary	15 (30.0)	30 (60.0)	5 (10.0)	0.011* / 19.8
Occupation				
Unemployed	16 (33.3)	28 (58.4)	4 (8.3)	
Unskilled	31 (35.5)	120 (60.0)	9 (4.5)	
Skilled	14 (26.9)	30 (57.7)	8 (15.4)	0.080 / 8.08
Religion				
Christianity	99 (33.7)	174 (59.2)	21 (7.1)	
Islam and African Traditional	2 (40.0)	4 (60.0)	0	0.893
Marital status				
Married	65 (33.9)	117 (60.9)	10 (5.2)	
Single	33 (34.7)	51 (53.7)	11 (11.6)	
Widowed, divorced or separated	3 (23.1)	10 (76.9)	0	0.362
Community				
Ogua	8 (40.0)	10 (50.0)	2 (10.0)	
Ujogba	5 (33.3)	8 (53.3)	2 (13.3)	
Ukhun	6 (30.0)	14 (70.0)	0	
Ebhuoakhua	20 (30.8)	40 (61.5)	5 (7.7)	
Ihumudumu	12 (37.5)	19 (59.4)	1 (3.1)	
Iruekpen	11 (32.4)	20 (58.8)	3 (8.8)	
Ujoelen	13 (27.1)	32 (66.7)	3 (6.3)	
Urohi	6 (46.2)	7 (53.8)	0	
Ehianle	13 (37.1)	18 (51.4)	4 (11.4)	
Illeh	7 (38.9)	10 (55.6)	1 (5.6)	0.953 / 9.26
Duration of stay (years)				
1 to 5	41 (68.3)	7 (11.7)	12 (20.0)	
6 to 10	43 (35.2)	70 (57.4)	9 (7.4)	
More than 10	17 (14.4)	94 (79.7)	7 (5.9)	0.094 / 7.94

Percentages add across rows. * $p < 0.05$.

Figure 3. Distribution of knowledge of Lassa fever among respondents

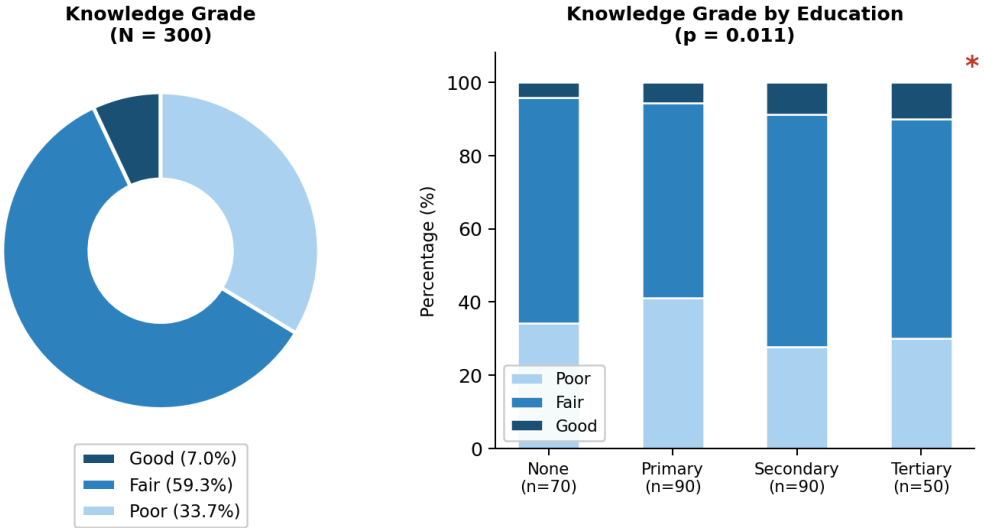

Figure 3. Distribution of knowledge grade (left) and knowledge grade by educational level (right)

Risk Assessment of Lassa Fever (Table 4, Figure 4)

High risk was recorded in 111 respondents (37.0%), moderate risk in 77 (25.7%), and low risk in 112 (37.3%). Sex was significantly associated ($\chi^2 = 7.67$, $p = 0.022$): 44.4% of females were high risk compared with 29.3% of males. Occupation was strongly significant ($\chi^2 = 8.91$, $p < 0.001$): high-risk classification was present in 46.2% of skilled and 41.5% of unskilled workers versus only 8.3% of the unemployed. Community of residence ($\chi^2 = 16.51$, $p < 0.001$) showed marked variation: Ukhun had the highest proportion of high-risk respondents (65.0%) and Ogua the lowest (0.0%). Duration of

residence was also significant (χ^2 = 65.65, p = 0.001): high-risk proportions rose from 25.4% (less than 6 years) to 52.5% (6 to 10 years) and 46.7% (more than 10 years). Age group (χ^2 = 4.83, p = 0.565), educational level (χ^2 = 7.77, p = 0.256), religion (p = 0.420), and marital status (p = 0.734) were not significantly associated.

Table 4: Risk level of Lassa fever by sociodemographic characteristics of respondents

Variable	Low N (%)	Moderate N (%)	High N (%)	p-value / χ^2
Age group (years)				
≤20	11 (26.8)	9 (22.0)	21 (51.2)	
21 to 40	45 (40.5)	28 (25.2)	38 (34.2)	
41 to 60	31 (39.2)	22 (27.8)	26 (32.9)	
>60	25 (36.2)	18 (26.1)	26 (37.7)	0.565 / 4.83
Sex				
Female	52 (34.0)	33 (21.6)	68 (44.4)	
Male	60 (40.8)	44 (29.9)	43 (29.3)	0.022* / 7.67
Educational level				
None	27 (38.6)	21 (30.0)	22 (31.4)	
Primary	28 (31.1)	29 (32.2)	33 (36.7)	
Secondary	35 (38.9)	16 (17.8)	39 (43.3)	
Tertiary	22 (44.0)	11 (22.0)	17 (34.0)	0.256 / 7.77
Occupation				
Unemployed	39 (81.3)	5 (10.4)	4 (8.3)	
Unskilled	33 (16.5)	84 (42.0)	83 (41.5)	
Skilled	23 (44.2)	5 (9.6)	24 (46.2)	<0.001*** / 8.91
Religion				
Christianity	110 (37.4)	77 (26.2)	107 (36.4)	
Islam and African Traditional	2 (40.0)	0	4 (60.0)	0.420
Marital status				
Married	74 (38.5)	52 (27.1)	66 (34.6)	
Single	34 (35.8)	21 (22.1)	40 (42.1)	
Widowed, divorced or separated	4 (30.8)	4 (30.8)	5 (38.5)	0.734
Community				
Ogua	13 (65.0)	7 (35.0)	0 (0.0)	
Ujogba	6 (40.0)	7 (46.7)	2 (13.3)	
Ukhun	5 (25.0)	2 (10.0)	13 (65.0)	
Ebhuoakhua	28 (43.1)	15 (23.1)	22 (33.8)	
Ihumudumu	9 (28.1)	11 (34.4)	12 (37.5)	
Iruekpen	13 (38.2)	12 (35.3)	9 (26.5)	
Ujoelen	14 (29.2)	10 (20.8)	24 (50.0)	
Urohi	8 (61.5)	0 (0.0)	5 (38.5)	
Ehianle	8 (22.9)	13 (37.1)	14 (40.0)	
Illeh	8 (44.4)	0 (0.0)	10 (55.6)	<0.001*** / 16.51
Duration of stay (years)				
1 to 5	59 (76.6)	32 (28.6)	31 (25.4)	
6 to 10	12 (15.6)	54 (48.2)	70 (52.5)	
More than 10	6 (7.8)	26 (23.2)	28 (46.7)	0.001** / 65.65

Percentages add across rows. * p < 0.05; ** p < 0.01; *** p < 0.001.

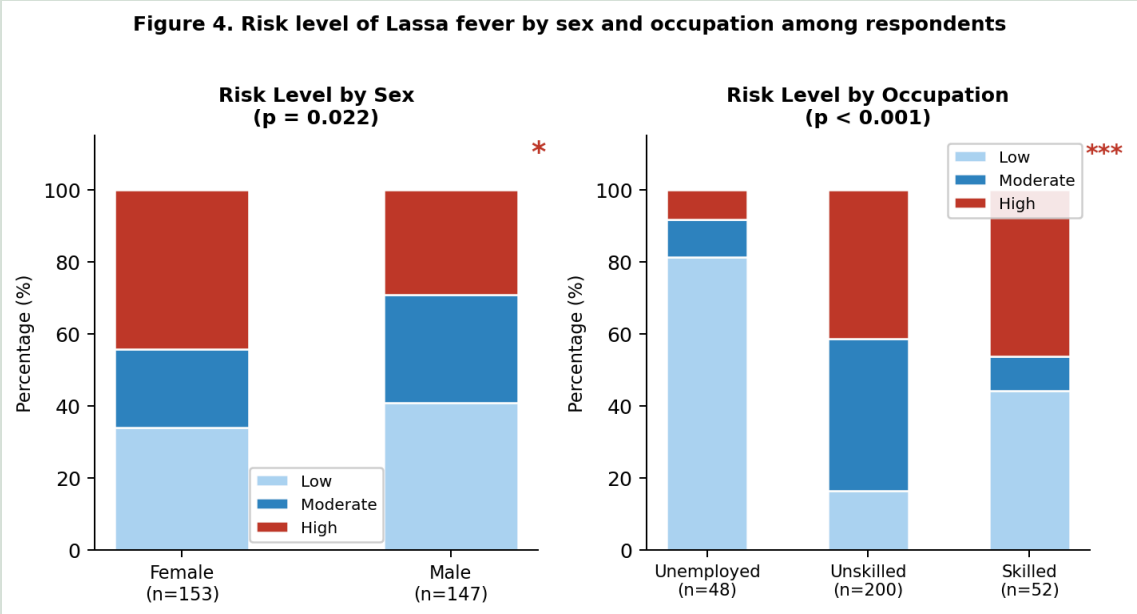

Figure 4. Risk level of Lassa fever by sex (left) and occupation (right) among respondents

Summary of Significant Associations (Table 5)

Educational level and occupation were predictors of both awareness and knowledge. Sex, occupation, community of residence, and

duration of stay were the principal determinants of risk level.

Table 5: Summary of significant associations between sociodemographic characteristics and awareness, knowledge, and risk level

Outcome variable	Predictor	p-value	Direction
Awareness	Educational level	0.011*	Higher education → more aware
Awareness	Occupation	0.001**	Skilled workers → more aware
Knowledge grade	Educational level	0.011*	Higher education → better knowledge
Knowledge grade	Occupation	0.080 (trend)	Skilled workers → better knowledge
Risk level	Sex	0.022*	Females → higher risk
Risk level	Occupation	<0.001***	Unskilled and skilled > unemployed
Risk level	Community	<0.001***	Ukhun highest (65.0% high risk)
Risk level	Duration of stay	0.001**	Longer residence → higher risk

* p < 0.05; ** p < 0.01; *** p < 0.001.

DISCUSSION

This study found low awareness (44.0%) and very low rates of good knowledge (7.0%) of Lassa fever among residents of Esan West LGA, alongside a substantial burden of high-risk behaviour (37.0%). These findings are consistent with reports from Ondo state, Nigeria, by *Olowookere et al.*[14] and *Tobin et al.*[15] in Edo state, confirming a persistent gap between disease endemicity and community health literacy in West Africa. Education was the sole significant predictor, consistent with a similar study carried out by *Saka et al.*[11] in Edo state, where the tertiary level of education was significantly associated with increased knowledge of Lassa fever. The non-significant age group effect indicates knowledge does not accumulate meaningfully with age, reinforcing the primacy of formal education over lived experience. Specific deficits in knowledge of person-to-person transmission and safe rat disposal represent particularly dangerous gaps.

The ISTH Outreach Team and electronic media were dominant awareness channels, but do not necessarily reflect their effectiveness in low-literacy rural settings. Print media accounted for only 1.8%, expected given 23.3% had no formal education. The significant associations of awareness with education and occupation confirm that information access is driven by literacy and occupational proximity to formal communication.[16,17] The near-significant trend for duration of stay suggests incremental accumulation of awareness with time in the community, though this did not translate into better knowledge.

The gender disparity in risk reflects domestic roles in rural African communities, bringing women into frequent contact with rodent-contaminated surfaces.[18] The unemployed had the lowest high-risk rate (8.3%), while skilled workers had the highest (46.2%), partly explained by employment in health facilities where nosocomial transmission occurs. Marked spatial variation in risk reflects heterogeneity in housing quality and sanitation. The progressive rise in risk with duration of residence is consistent with cumulative exposure and entrenchment of risk behaviours. Age group was not a significant predictor of risk.

Limitations of this study include the cross-sectional design, researcher-developed scoring tool, potential social desirability bias, and data from 2013. Awareness estimates for collapsed age groups were proportionally derived, as fine age-stratified awareness counts were not provided in the original dataset.

CONCLUSION

Awareness and good knowledge of Lassa fever were low among residents of Esan West LGA. Education was the primary determinant of both awareness and knowledge, while sex, occupation, community of residence, and duration of stay were the principal predictors of risk level. We recommend a shift from passive information delivery to peer-driven, structural, and incentivised interventions that embed health education into daily survival and cultural routines. This may include: Market-day “Clean and Earn” Competitions. This leverages intense peer pressure and commercial pride, turning market leaders into enforcement figures. Another approach is the “True Story” Cinema & Comedy Caravan. Gathering for free nighttime screening creates a communal event. Hearing direct testimonies from neighbours strips away the myth that the disease is spiritual or fake. Other recommended approaches are: Religious “Scripture and Health” Integration, Primary School “Child-to-Parent” Knowledge Pipelines, and Point-of-Sale (POS) and Mill dissemination of infographics on Lassa fever transmission.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

This study received no external funding.

ACKNOWLEDGEMENTS

The authors thank the ISTH outreach team, medical students of Ambrose Alli University, Ekpoma, and all community participants.

References

18 sources

1 World Health Organisation. Lassa fever [Internet]. 2024. Available from: https://www.who.int/news-room/fact-sheets/detail/lassa-fever

2 Agbonlahor DE, Akpede GO, Happi CT, Tomori O. 52 Years of Lassa Fever Outbreaks in Nigeria, 1969–2020: An Epidemiologic Analysis of the Temporal and Spatial Trends. Am J Trop Med Hyg. 2021 Oct 1;105(4):974. doi:10.4269/AJTMH.20-1160 PubMed PMID: 34460421.

3 Monath TP. A short history of Lassa fever: the first 10–15 years after discovery. Curr Opin Virol. 2019 Aug 1;37:77–83. doi:10.1016/J.COVIRO.2019.06.005 PubMed PMID: 31323506.

4 Amifofum OS, Ogunsumi D, Awosanya E, Icomiare A, Evbuomwan K, Balogun MS, et al. Spatial analysis of confirmed Lassa fever cases in Edo State, Nigeria, 2008 - 2014. PAMJ-OH 2021; 5:11. 2021 Jun 29;5(11). doi:10.11604/PAMJ-OH.2021.5.11.24710

5 Al-Mustapha AI, Adesiyan IM, Orum TG, Ogundijo OA, Lawal AN, Nzedibe OE, et al. Lassa fever in Nigeria: epidemiology and risk perception. Sci Rep. 2024 Dec 1;14(1):27669. doi:10.1038/S41598-024-78726-3 PubMed PMID: 39532966.

6 Bonwitt J, Sáez AM, Lamin J, Ansumana R, Dawson M, Buanie J, et al. At Home with Mastomys and Rattus: Human-Rodent Interactions and Potential for Primary Transmission of Lassa Virus in Domestic Spaces. Am J Trop Med Hyg. 2017;96(4):935. doi:10.4269/AJTMH.16-0675 PubMed PMID: 28167603.

7 Uppala PK, Karanam SK, Kandra NV, Edhi S. Lassa fever: A comprehensive review of virology, clinical management, and global health implications. World J Virol. 2025 Sep 25;14(3):108405. doi:10.5501/WJV.V14.I3.108405 PubMed PMID: 41025087.

8 Reyna RA, Littlefield KE, Shehu N, Makishima T, Maruyama J, Paessler S. The Importance of Lassa Fever and Its Disease Management in West Africa. Viruses 2024, Vol 16, Page 266. 2024 Feb 7;16(2):266. doi:10.3390/V16020266 PubMed PMID: 38400041.

9 Abiodun OP, Abiodun-Omogoye FA. Measuring knowledge, attitudes, and practices in Lassa fever prevention: A cross-sectional survey from Kailahun and Kenema Districts, Sierra Leone. Journal of Interventional Epidemiology and Public Health. 2025 Aug;8:AbstractELIC2025165 (Poster 143). doi:10.37432/JIEPH-CONFPRO5-00287

10 Dolopei D, Amo-Addae M, Adewuyi P, Wilson H, Shannon F, Lawubah J, et al. Knowledge, attitudes and practices (KAP) regarding Lassa fever disease among adults in endemic and non-endemic Counties of Liberia, 2018: A Cross-sectional study. Journal of Interventional Epidemiology and Public Health. 2021 Jun 6;4(2). doi:10.37432/jieph.supp.2021.4.2.01.9

11 Saka SA, Ojo DO, Mezu NM, Uzuegbu CO, Ighodaro O, Illoh OO, et al. Knowledge, perception and preventive practices of Lassa fever among mothers of under-five children in an endemic community in Edo State, Nigeria. BMC Public Health. 2025 Dec 1;25(1):837. doi:10.1186/S12889-025-22057-Z PubMed PMID: 40033294.

12 Alenoghena I, Omuemu V. Knowledge and Risk Factors of Lassa Fever among Household Members in a Rural Community in Edo State, Southern Nigeria. Ibom Medical Journal. 2021 Jul 1;14(3):296–309. doi:10.61386/IMJ.V14I3.51

13 Tomori O, Fabiyi A, Sorungbe A, Smith A, McCormick JB. Viral hemorrhagic fever antibodies in Nigerian populations. Am J Trop Med Hyg. 1988;38(2):407–10. doi:10.4269/AJTMH.1988.38.407 PubMed PMID: 3128130.

14 Olowookere SA, Adegbenro CA, Idowu A, Omisore AG, Shabi OM, Ikem UR, et al. Knowledge, Attitude and Practices Toward Lassa Fever Control and Prevention Among Residents of Ile-Ife, Southwest Nigeria. Int Q Community Health Educ. 2017 Jan 1;37(2):107–12. doi:10.1177/0272684X17701261 PubMed PMID: 28511600.

15 Tobin EA, Asogun D, Happi C, Ogbaini E, Gunther S. Risk factors for Lassa fever in endemic communities of Edo State, Nigeria. International Journal of Infectious Diseases. 2014 Apr 1;21:258–9. doi:10.1016/j.ijid.2014.03.958

16 Sudirman. The Role of Health Literacy in Improving Health Outcomes: Challenges, Interventions, and Policies. Journal of Health Literacy and Qualitative Research. 2022 Mar 31;2(1):15–30. doi:10.61194/JHLQR.V2I1.530

17 Wiedermann CJ, Barbieri V, Lombardo S, Gärtner T, Rina P, Eisendle K, et al. Health Information Use and Trust: The Role of Health Literacy and Patient Activation in a Multilingual European Region. Int J Environ Res Public Health. 2025 Apr 1;22(4):570. doi:10.3390/IJERPH22040570/S1 PubMed PMID: 40283795.

18 Oruganti P, Root E, Ndlovu V, Mbhungele P, Van Wyk I, Berrian AM. Gender and zoonotic pathogen exposure pathways in a resource-limited community, Mpumalanga, South Africa: A qualitative analysis. PLOS Global Public Health. 2023 Jun 1;3(6):e0001167. doi:10.1371/JOURNAL.PGPH.0001167 PubMed PMID: 37276220.

HOW TO CITE

Nosa Akpede, Mojeed Olaitan Rafiu, Kingsley Osuji, Francis Osemhoahu Erah, George Obozokhale Akpede, Danny Akhere Asogun. KNOWLEDGE, AWARENESS, AND RISK ASSESSMENT OF LASSA FEVER AMONG RESIDENTS OF ESAN WEST LOCAL GOVERNMENT AREA, EDO STATE, NIGERIA. *Delta Oghara Medical Journal*. 2026;2(1).

https://domj.org/index.php/start/article/view/knowledge-awareness-risk-assessment-lassa-fever-esan-west-edo-state

Scan to view article

ORIGINAL ARTICLE OPEN ACCESS

PREVALENCE OF PREAURICULAR SINUS AMONGST ANNANGS AND IBIBIOS

Mfon Ime Inoh[1*], Akpan Udo Ekanem[2], Elizabeth Enene Inoh[3], Chinaza Samuel Ikechukwuka[4]

AFFILIATIONS

1 Department of ENT/Surgery, University of Uyo Teaching Hospital/University of Uyo, Akwa Ibom State, Nigeria.

2 Department of Anatomy, University of Uyo, Akwa Ibom State, Nigeria.

3 Department of Community Medicine, University of Uyo Teaching Hospital/University of Uyo, Akwa Ibom State, Nigeria

4 Department of Anatomy, University of Uyo, Akwa Ibom State, Nigeria

CORRESPONDING AUTHOR(S)

Mfon Ime Inoh
drinohmi@gmail.com
08033677958

ARTICLE HISTORY

Received 12/06/2026
Accepted 29/06/2026
Published 01/08/2026

ABSTRACT

A preauricular sinus is a congenital anomaly that occurs at the anterior margin of the ascending limb of the helix of the external ear. Its prevalence varies significantly across different ethnic and geographical populations worldwide. This study aimed to determine its prevalence among Annang and Ibibio patients attending an ENT outpatient clinic in Southern Nigeria.

It is a cross-sectional observational study, involving a systematic observation and assessment of patients attending the ENT outpatient clinic of the University of Uyo Teaching Hospital, Akwa Ibom State.

Three hundred and two subjects with a mean age of 25.2 years were recruited in this study, out of which 35.4% [107/302] were of the Annang tribe and 64.6% [195/302] were of the Ibibio tribe. The M:F ratio of respondents was 1:1.5. A prevalence of 17.6% [53/302] was noted. The Annang subjects had the highest prevalence rate of 19.6% [21/107], while the Ibibios had 16.4% [32/195]. Only 24% [72/302] of the participants had heard of PAS prior to the survey, while 25% [18/72] of those affected sought medical attention. Health education to improve public awareness of the condition is advocated.

Pre-auricular sinus | Annang | Ibibio

INTRODUCTION

Preauricular sinus (PAS) is an interesting congenital anomaly of the preauricular soft tissue that Carl Friedrich von Heusinger first described.[1,2] It is a common abnormality of the head and neck region that usually occurs at the anterior margin of the ascending limb of the helix of the external ear.[1]

The most accepted theory suggests that PAS arises when there is an incomplete or defective fusion of the six auditory hillocks of His, which are responsible for the embryogenesis of the auricle.[3,4] The sinus is typically located anterior to the helix or near the tragus, reflecting its embryonic origin.[1,5] A less accepted hypothesis suggests that PAS develops during the embryonic stage from an isolated ectodermal folding.[1,6] Genetically, preauricular sinus is inherited in an incomplete autosomal dominant pattern, with a reduced penetrance pattern and variable power of expression commonly seen in bilateral cases.[1]

The prevalence of PAS varies significantly across different ethnic and geographical populations of the world, with higher rates reported among certain African and Asian populations.[2,4,7] The reported prevalence varies between 0.1 – 0.9% in USA and England, 1.6 – 6% in Asia, and 3 – 10 % in African regions.[8]

It is more often unilateral, while bilateral forms usually occur as an inherited disorder, and their association with deafness and as part of syndromic disorders has been reported.[1,9] The presence of a PAS should prompt further evaluation to rule out renal or auditory abnormalities.[9]

It is a congenital malformation that may go unnoticed in many individuals, but warrants medical attention when symptoms arise. The most common complications associated with PAS is infection, which can lead to recurrent abscess formation or persistent sinus drainage, often requiring both medical and surgical interventions.[9]

Despite numerous studies conducted globally, there is no data specifically addressing the prevalence and awareness of preauricular sinus amongst the Annang and Ibibio populations of Southern Nigeria. The Annang and Ibibios are the two major closely related ethnic groups in Akwa Ibom state, that share deep cultural, ancestral and linguistic ties. While PAS is a relatively common congenital anomaly, much of its research has focused on Asian and Western populations.[10] This study, therefore, aims to determine the prevalence of preauricular sinus amongst the Annang and Ibibio patients attending an ENT outpatient clinic in Southern Nigeria.

METHODOLOGY

This is a cross-sectional study that involved the systematic observation and assessment of patients attending the ENT outpatient clinic of the University of Uyo Teaching Hospital from January to March 2026. Only persons aged 10 years and above who were monoethnic natives of the Annang or Ibibio ethnic groups of Southern Nigeria were recruited for the study. Congenital anomalies such as microtia and anotia were excluded from the study. Informed consent was obtained from all eligible patients who presented to the clinic. A thorough head and neck examination was conducted to identify the presence of any PAS, and data were collected using an interviewer-administered questionnaire. Data collected included age, sex, tribe, knowledge of PAS, and educational status. All data were coded and analyzed using IBM SPSS Statistics version 27.0, with descriptive and inferential statistical methods employed. The level of statistical significance was set at $p < 0.05$. Results were presented using frequency tables and charts where applicable.

Figure 1: Diagram showing a preauricular sinus.

RESULTS

Three hundred and two subjects with a mean age of 25.2 years were recruited in this study, out of which 35.4% [107/302] were of the Annang tribe and 64.6% [195/302] were of the Ibibio tribe. The M:F ratio of respondents was 1:1.5.

Table 1: Demographic characteristics of the study population.

Variable	Category	Frequency (n)	Percentage (%)
Age Group (years)	10 – 20	61	20.2
	21 – 30	103	34.1
	31 – 40	86	28.5
	41 – 50	32	10.6
	51 – 60	16	5.3
	> 61	4	1.3
Subjects by Ethnic Group	Annang	107	35.4
	Ibibio	195	64.6
Sex	Female	181	59.9
	Male	121	40.1
Educational qualification	No formal education	2	0.7
	Primary	37	12.3
	Secondary	112	37.1
	Tertiary	151	50.0

Fifty-three of the 302 participants in this study had PAS (M:F ratio of 1:1.3), demonstrating an overall prevalence of 17.6%. Seven (13.2%) were bilateral, and 46 (86.8%) were unilateral (25 right-sided, 21 left-sided).

The prevalence of PAS among the Annangs was 19.6% [21/107], and 16.4% [32/195] for the Ibibios with no statistically significant ethnic variation (p = 0.558).

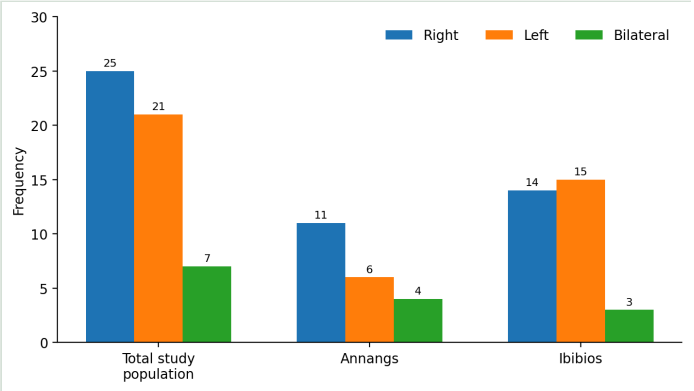

Figure 2: Laterality patterns of PAS in the Annangs and Ibibios

A positive family history of PAS was defined as the presence of a PAS in a first-degree relative. Of the 53 respondents identified with PAS, 22 (41.5%) had a positive family history. All 7 (100.0%) respondents with bilateral PAS and 15 (32.6%) of those with unilateral PAS had a positive family history. There was no statistically

significant association between bilaterality of PAS and positive family history (p = 0.592).

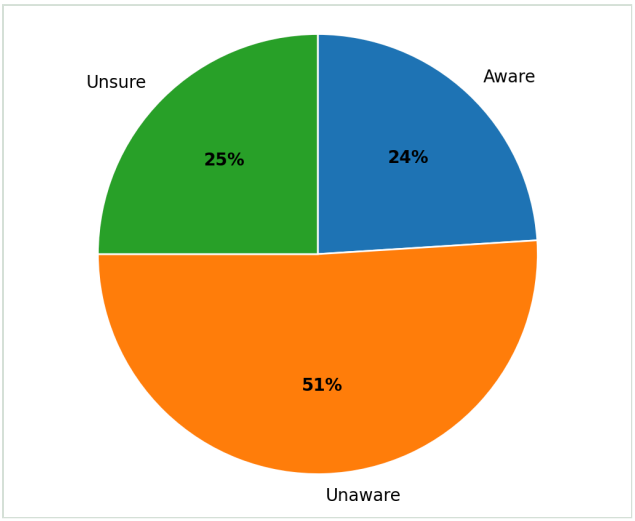

Figure 3: Knowledge of PAS among the study population.

Only 60% [32/53] of respondents with PAS were aware of having the condition before the survey, with 15.1% [8/53] having experienced symptoms related to PAS, and sought medical attention. The symptoms occurred more in those with bilateral PAS 62.5% [5/8]. None of the subjects with PAS had other auricular defects, dysmorphic facial features, or any other sinuses or fistulas in the head and neck region.

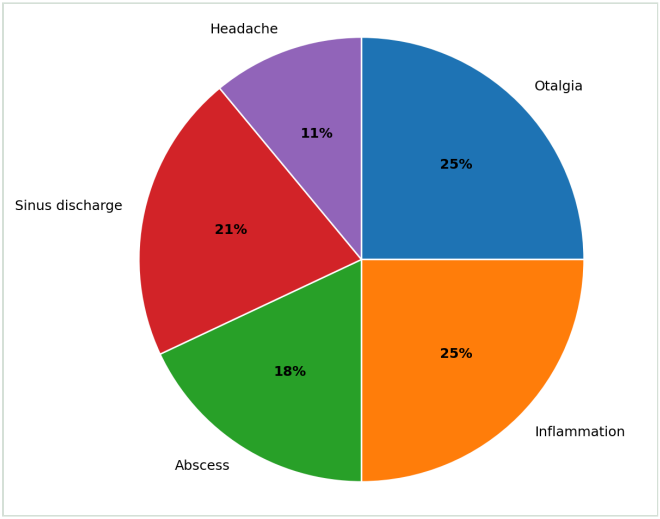

Figure 4: Symptomatology of PAS

DISCUSSION

The present study represents the first investigation of PAS in these ethnic groups. Although the prevalence rate observed in our study was higher, it remains consistent with the broader finding that PAS is more common among African populations.[8,11]. Previous Nigerian studies, predominantly conducted in the South-West and encompassing all age groups, reported slightly lower prevalence rates than ours.[2,6,12] Like many of those South-western studies, our work was hospital-based, with the observed inter-study differences possibly reflecting genetic or environmental predispositions.[2,13]Notably, the Annang ethnic group exhibited the highest prevalence in our study. While global prevalence rates of PAS appear to vary considerably, most published studies have examined ethnically homogenous samples and have not specifically explored differences between ethnic groups co-habiting the same geographic area. [14,15]

The literature presents conflicting evidence regarding sex predisposition to the development of PAS.[2,4] While some studies have reported an equal distribution between sexes, others have observed a male predominance.[6,14,16] In contrast, our study identified a female preponderance, corroborating findings from other reports.[12,17]

PAS may occur sporadically or be inherited; bilateral lesions are more frequently associated with a hereditary pattern.[3] In the present cohort, no statistically significant association was observed between a positive family history and the development of PAS. However, this negative finding should be interpreted with considerable caution, given the limited number of affected individuals identified. Accordingly, these data do not preclude a heritable component, as has been substantiated in prior otolaryngology and genetic literature. Our study failed to demonstrate an association between positive family history and bilateral PAS. Nevertheless, given the small number of affected persons, this finding is inconclusive and does not exclude a potential genetic link.[18,19] In addition, environmental causes have been suggested in the aetiopathogenesis of PAS.[5] A prior report from Israel has suggested that PAS may function as an epidemiological marker of teratogenic exposure, with its decreasing incidence reflective of reduced environmental teratogens.[20] Extending this reasoning to our setting, the petrochemical byproducts associated with crude and gas exploration in the Annang and Ibibio territories could represent a relevant teratogenic exposure. This offers a plausible, albeit speculative, explanation for the relatively high PAS prevalence seen in our study.

Concerning laterality, right-sided PAS was more prevalent than left-sided PAS in our study, a finding consistent with previous reports.[6,13,19] However, a left-sided predominance has also been documented in other series.[2,14] These discrepancies may simply reflect random variation or underlying environmental influences

Another notable finding was the low level of PAS awareness among our cohort. Only 24% [72/302] of the participants had heard of PAS prior to the survey, and merely 25% [18/72] of those affected sought medical attention. This aligns with the observations of Alshehri and Hadi, who attributed the under recognition of minor congenital ear anomalies to inadequate public health education.[21] In the literature, 17% - 47% of individuals with PAS are reported to be symptomatic, which is consistent with our data.[22] These findings suggest that PAS is frequently overlooked unless it becomes symptomatic. Consequently, there is a pressing need to incorporate congenital anomaly screening into routine general health checkups. Among those who did present for care, the commonly reported symptoms - otalgia, inflammation, sinus discharge, abscess, and headaches – were comparable to those reported elsewhere. [2,22]

CONCLUSION

This study revealed a statistically non-significant differential prevalence of PAS between Annang and Ibibio patients attending an ENT outpatient clinic. There was no association between a positive family history of PAS and bilaterality of the condition. We advocate for enhanced health education to improve public awareness of the clinical characteristics of PAS.

References

22 sources

1 Bruce I, Nichani J. Microtia and External Ear Abnormalities. Scott-Brown's Otorhinolaryngology and Head and Neck Surgery, Eighth Edition: Vol 1-3. 2018;1–3:165–73.

2 Jimoh R, Alabi S, Ajao M, Adebayo SS. Prevalence of Preauricular Sinus among Nigerians. Surg J. 2008; 3:61–3.

3 Zou F, Peng Y, Wang X, Sun A, Liu W, Bai S, et al. A Locus for Congenital Preauricular Fistula Maps to Chromosome 8q11.1-q13.3. J Hum Genet. 2003; 48(3):155–8.

4 Adegbiji WA, Alabi BS, Olajuyin OA, Nwawolo CC. Presentation of Preauricular Sinus and Preauricular Sinus Abscess in Southwest Nigeria. Int J Biomed Sci. 2013; 9(4):260.

5 Xin YH, Guan ST, Wansaicheong GKL, Low WK. Preauricular Sinus: Clinical Course and Associations. Arch Otolaryngol Head Neck Surg. 2007; 133(1):65–8.

6 Adedeji TO, Tobih JE, Idowu JA, Olaosun AO, Fayanju AO. Prevalence of Preauricular Sinus in LAUTECH Teaching Hospital, Osogbo, Southwest, Nigeria. Journal of Rhinolaryngo-Otologies. 2015; 3(1):12–6.

7 Kumar Chowdary KVS, Sateesh Chandra N, Karthik Madesh R. Preauricular sinus: a novel approach. Indian J Otolaryngol Head Neck Surg. 2012; 65(3):234–6.

8 Odhiambo A, Rotich EC, Chindia ML, MacIgo FG, Ndavi M, Were F. Craniofacial Anomalies amongst Births at Two Hospitals in Nairobi, Kenya. Int J Oral Maxillofac Surg. 2012; 41(5):596–603.

9 Delwar AHM, Mazamder JA, Md Shazibur R, Md Golam M. Preauricular Sinus: A Three-Year Experience and Appreciation. Scientific Research Journal. 2020; 08(02):75–81.

10 Baatenburg De Jong RJ. A New Surgical Technique for Treatment of Preauricular Sinus. Surgery. 2005; 137(5):567–70.

11 Xin YH, Guan ST, Wansaicheong GKL, Low WK. Preauricular sinus: clinical course and associations. Arch Otolaryngol Head Neck Surg. 2007; 133(1):65–8.

12 Sogebi O, Oyewole E. A Facility-based Study of Preauricular Sinus Among Adults in Southwest Nigeria. Annals of Health Research. 2021 Mar 3; 7(1):29–38.

13 Adeyemo A, Ijaduola G. Socio-cultural Beliefs in the Management of Preauricular Sinus. The Internet Journal of Head and Neck Surgery. 2006; 1(2).

14 Yu CV., Khera KD, Pauwels J, Chadha NK. Prevalence and Ethnic Variation of Preauricular Sinuses in Children. Int J Pediatr Otorhinolaryngol. 2016; 80:43–8.

15 Kayode AS, Wasiu O. Preauricular Sinus-Classic versus Variant Types among a Cross-section of Subjects in Southwestern Nigeria. J Adv Med Med Res. 2018; 27(7):1–10.

16 Gupta R, Agrawal A, Poorey VK. Preauricular Sinus: A Clinicopathological Study. Int J Res Med Sci. 2015; 3274–7.

17 Lee KY, Woo SY, Kim SW, Yang JE, Cho YS. The Prevalence of Preauricular Sinus and Associated Factors in a Nationwide Population-Based Survey of South Korea. Otology and Neurotology. 2014; 35(10):1835–8.

18 Matev B, Lyutfi E, Stoyanov GS, Sapundzhiev NR. Preauricular Sinus: A Tale of Forgetful Rediscovery. Cureus. 2020; 12(6).

19 Tan T, Constantinides H, Mitchell TE. The Preauricular Sinus: A review of its Aetiology, Clinical Presentation and Management. Int J Pediatr Otorhinolaryngol. 2005; 69(11):1469–74.

20 Merlob P, Aitkin I. Time trends (1980-1987) of ten selected informative morphogenetic variants in a newborn population. Clin Genet. 1990; 38(1):33–7.

21 Alshehri AA, Al Hadi AM, Alyami LHA, Al Sulaiman IN, Al Hadi EM, Al Hareth SY. The Prevalence and Awareness of Congenital External Ear Deformity among the School-Age Group: A Cross-Sectional Study. Facial Plastic Surgery. 2024; 41(4):436–43.

22 Adegbiji, W.A., Alabi, B.S., Olajuyin, O.A. and Nwawolo, C.C. Presentation of Preauricular Sinus and Preauricular Sinus Abscess in Southwest Nigeria. International Journal of Biomedical Science. 2013; 9, 260-263

HOW TO CITE

Mfon Ime Inoh, Akpan Udo Ekanem, Elizabeth Enene Inoh, Chinaza Samuel Ikechukwuka. PREVALENCE OF PREAURICULAR SINUS AMONGST ANNANGS AND IBIBIOS. *Delta Oghara Medical Journal*. 2026;2(1).

https://domj.org/index.php/start/article/view/prevalence-preauricular-sinus-amongst-annangs-ibibios

Scan to view article

ORIGINAL ARTICLE OPEN ACCESS

Utility of NT-proBNP in the Diagnosis of Heart Failure Phenotypes in a Sub-Saharan African Population

Haruna Abubakar Alhaji[1,2], Ayoola Yekeen Ayodele[1*], Hussain Muhammad Sulaiman[2], Babalawan Muhammad[2], Kabir Abdussalam[3], Mohammed Fatima Isa[1]

AFFILIATIONS

1 Department of Internal Medicine, Gombe State University, Gombe

2 Department of Internal Medicine, Cardiology Unit, Aminu Kano Teaching Hospital, Kano, Nigeria

3 Department of Chemical Pathology, Aminu Kano Teaching Hospital, Kano, Nigeria

CORRESPONDING AUTHOR(S)

Dr. Ayoola Yekeen Ayodele
Department of Internal Medicine
Gombe State University
P.M.B 127, Tudun Wada, Gombe, Gombe State, Nigeria
dryekeen@gmail.com

ARTICLE HISTORY

Received 02/06/2025
Accepted 03/12/2025
Published 01/08/2026

ABSTRACT

Background:

N-terminal pro-B-type Natriuretic Peptide (NT-proBNP) is a cornerstone in the diagnostic algorithm for heart failure (HF). However, its behaviour across different HF phenotypes, particularly in sub-Saharan African (SSA) populations where patient characteristics and HF aetiologies differ, is not well described. This study evaluated the utility of NT-proBNP in diagnosing HF phenotypes in a Nigerian cohort using the 2016 European Society of Cardiology (ESC) criteria.

Methods:

In a prospective observational study, 130 adults with HF were classified into HF with reduced ejection fraction (HFrEF, LVEF<40%), mid-range EF (HFmrEF, LVEF 40-49%), and preserved EF (HFpEF, LVEF≥50%) based on comprehensive assessment including echocardiography and clinical evaluation. Plasma NT-proBNP was measured using a high-sensitivity ELISA. The Kruskal-Wallis test was used to compare NT-proBNP levels across phenotypes. Diagnostic performance was assessed by the proportion of patients meeting the ESC NT-proBNP threshold (>125 pg/mL for ambulatory and >300 pg/mL for hospitalized patients).

Results:

The median NT-proBNP level for the entire cohort was 3800.0 pg/mL (IQR: 2900.0-4500.0). All 130 patients (100%) had NT-proBNP levels above the ESC diagnostic thresholds. There was no significant difference in median NT-proBNP levels between the three phenotypes (HFrEF: 3900.0 pg/mL [IQR: 3075-4600], HFmrEF: 3700.0 pg/mL [IQR: 2275-3700], HFpEF: 3850.0 pg/mL [IQR: 2700-4325]; p=0.461). The biomarker was equally elevated in both inpatient and outpatient settings.

Conclusion:

NT-proBNP is a highly sensitive biomarker for confirming the diagnosis of HF in this SSA population, with 100% of patients exceeding the recommended ESC cut-offs. Contrary to findings from other regions, NT-proBNP levels were uniformly and markedly elevated across all HF phenotypes, showing no discriminatory value between HFrEF, HFmrEF, and HFpEF. This suggests that while NT-proBNP is indispensable for ruling out HF in this setting, its level cannot be used to infer the underlying phenotype.

N-terminal pro-B-type Natriuretic Peptide | Heart Failure | Diagnosis | Phenotypes | Sub-Saharan Africa | Echocardiography | Biomarker

Introduction

Heart failure (HF) is a global pandemic with a particularly devastating impact in sub-Saharan Africa (SSA), where it affects a younger population and is driven by a unique mix of aetiologies, including hypertensive heart disease, cardiomyopathies, and rheumatic heart disease. [1, 2] Accurate diagnosis is the critical first step in effective management. However, the clinical diagnosis of HF can be challenging, as its signs and symptoms are non-specific and can be mimicked by other conditions such as obesity, chronic lung disease, and renal failure.[3]

The incorporation of natriuretic peptides (NPs), B-type natriuretic peptide (BNP) and its N-terminal pro-hormone (NT-proBNP), into diagnostic guidelines has been a major advance in the management of HF.[4] These peptides are released primarily from the cardiac ventricles in response to volume expansion and pressure overload, making them sensitive biomarkers of myocardial wall stress.[5] The 2016 guidelines of the European Society of Cardiology (ESC) mandate elevated levels of NPs as a necessary criterion for the diagnosis of HF, especially for the challenging entity of heart failure with preserved ejection fraction (HFpEF).[6] The recommended diagnostic thresholds are NT-proBNP >125 pg/mL for ambulatory patients and >300 pg/mL for those who are hospitalized.[6]

While the diagnostic utility of NPs is well-established in high-income countries, their performance characteristics can be influenced by age, renal function, body mass index (BMI), and the aetiology of HF.[7,8] In SSA, where the HF profile is distinct, data on NT-proBNP are scarce. Patients present at a younger age, and comorbidities like obesity and renal disease may have differing prevalences and impacts.[9] Furthermore, studies from other regions typically show a gradient of NP levels, with the highest concentrations in HF with reduced ejection fraction (HFrEF) and lower, though still elevated, levels in HFpEF.[10,11]This is pathophysiologically plausible because HFrEF, characterized by dilated ventricles, generates greater wall stress than the thick-walled, small-cavity ventricles often seen in HFpEF.[12]

It remains unclear whether this NP gradient between phenotypes holds true in SSA populations. A previous study from Nigeria reported significantly elevated BNP levels in HF patients compared to controls but did not perform a detailed cross-phenotype analysis.[13] Understanding the behaviour of NT-proBNP across the spectrum of HF in SSA is crucial for validating current international guidelines in this context and for informing local diagnostic pathways.

Therefore, this study aimed to evaluate the utility of NT-proBNP in the diagnosis of HF phenotypes in a prospective cohort of Nigerian patients, specifically assessing its sensitivity in confirming HF diagnosis according to ESC criteria and its ability to discriminate between HFrEF, HFmrEF, and HFpEF.

Methods

Study Design and Population

This was a prospective observational study conducted at the Aminu Kano Teaching Hospital (AKTH), Kano, Nigeria, between October 2019 and May 2020. The study enrolled 130 consecutive adult patients (age ≥18 years) with a clinical diagnosis of HF. Patients were recruited from the emergency department, cardiology clinic, and general medical wards. Exclusion criteria included inability to provide informed consent, age <18 years, and poor echocardiographic windows.

The study was approved by the AKTH Health Research Ethics Committee, and all participants provided written informed consent.

Diagnostic Criteria and Patient Classification

The diagnosis and classification of HF were strictly based on the 2016 ESC guidelines.[6]

- **HF Diagnosis:** Required the presence of typical symptoms (e.g., breathlessness, orthopnoea, fatigue) and/or signs (e.g., elevated jugular venous pressure, pulmonary crackles, peripheral oedema) caused by a structural or functional cardiac abnormality.
- **Phenotype Classification:** Patients were classified into three groups based on left ventricular ejection fraction (LVEF) measured by echocardiography:
- HFrEF: LVEF <40%
- HFmrEF: LVEF 40-49%
- HFpEF: LVEF ≥50%
- **Additional Criteria for HFpEF and HFmrEF:** For a diagnosis of HFpEF or HFmrEF, in addition to symptoms/signs and the respective LVEF, an elevated NT-proBNP level was required alongside objective evidence of other cardiac structural or functional alterations. This evidence included at least one of the following:
- Left atrial volume index (LAVI) >34 mL/m²
- Left ventricular mass index (LVMI) ≥115 g/m² for males or ≥95 g/m² for females
- E/e' ratio ≥13
- Average e' (septal and lateral) <9 cm/s

Clinical and Echocardiographic Assessment

All patients underwent a detailed clinical evaluation, including history, physical examination, and assessment of NYHA functional class. Echocardiography was performed by a trained investigator under the supervision of a consultant cardiologist using a Sonoscape SSI 8000 ultrasound system, according to contemporary guidelines.[14] Standard 2D, M-mode, and Doppler measurements were obtained. LVEF was calculated using the Teichholz method. Diastolic function was assessed using pulsed-wave Doppler of the mitral inflow and tissue Doppler imaging of the mitral annulus.

Blood Sample Collection and NT-proBNP Measurement

Venous blood samples were collected from each participant after an 8-12 hour overnight fast at the time of recruitment. Samples were drawn into gel separator tubes under aseptic conditions. The samples were allowed to clot and then centrifuged at 2000-3000 rpm for 20 minutes to separate the serum. The serum was aliquoted and stored at -20°C until analysis.

Serum NT-proBNP levels were quantitatively measured using a high-sensitivity competitive Enzyme-Linked Immunosorbent Assay (ELISA) kit (E1239Hu, Bioassay Technology Laboratory). The assay procedure followed the manufacturer's instructions. In brief, the assay uses a monoclonal antibody coated onto a microtitre plate. NT-proBNP in the sample competes with an NT-proBNP-horseradish peroxidase (HRP) conjugate for binding sites. After incubation and washing, a substrate solution is added, and the colour developed is inversely proportional to the concentration of NT-proBNP in the sample. The reaction was stopped, and the absorbance was read at 450 nm using a BIORAD microplate reader (model PR 3100 TSC). A calibration curve was constructed from calibrators of known concentration, and the NT-proBNP concentration of the samples was deduced from this curve. All samples were run in duplicate.

The intra-assay coefficient of variation (CV) was <8%, and the inter-assay CV was <10%. The assay has a detection limit of 4.12 ng/L and is linear up to 1900 ng/L.

Statistical Analysis

Data were analysed using SPSS version 21 (IBM Corp., Armonk, NY). Continuous variables were tested for normality using the Shapiro-Wilk test. Normally distributed data were presented as mean ± standard deviation (SD), and non-normally distributed data (including NT-proBNP) were presented as median with interquartile range (IQR). Categorical variables were expressed as frequencies and percentages. The Kruskal-Wallis test was used to compare NT-proBNP levels across the three HF phenotypes (HFrEF, HFmrEF, HFpEF). The Mann-Whitney U test was used to compare NT-proBNP

levels between inpatients and outpatients. A two-sided p-value of <0.05 was considered statistically significant. The diagnostic sensitivity of NT-proBNP was calculated as the proportion of patients with NT-proBNP levels above the ESC-recommended cut-offs.

Results

Baseline Characteristics of the Study Cohort

A total of 130 patients was included in the final analysis. The baseline demographic, clinical, and echocardiographic characteristics of the cohort, stratified by HF phenotype, are presented in Table 1. The mean age of the participants was 49.8 ± 18.1 years, with 76 (58.5%) being female. Patients with HFpEF were older than those with HFrEF (mean age 54.5 vs. 46.8 years, p=0.070 for trend, with 41.2% of HFpEF patients ≥65 years vs. 19.2% of HFrEF, p=0.032).

The most common aetiology of HF in the entire cohort was hypertensive heart disease (50.0%), followed by peripartum cardiomyopathy (19.2%) and ischaemic heart disease (11.5%). As expected, echocardiographic parameters differed significantly between groups. LV end-diastolic dimension was largest in HFrEF and smallest in HFpEF (67.4 mm vs. 51.3 mm, p<0.001). Conversely, parameters indicative of diastolic dysfunction, such as E/A ratio and deceleration time, showed a pattern consistent with more advanced diastolic impairment in HFrEF (higher E/A, shorter DT) but confirmed the presence of diastolic dysfunction in all groups.

Table 1: Baseline Characteristics of the Study Population Stratified by Heart Failure Phenotype

Characteristic	All Patients (N=130)	HFrEF (n=78)	HFmrEF (n=18)	HFpEF (n=34)	P-value
Demographics					
Age (years), mean ± SD	49.8 ± 18.1	46.8 ± 17.0	53.7 ± 16.2	54.5 ± 19.5	0.070
Female, n (%)	76 (58.5)	48 (61.5)	9 (50.0)	19 (55.9)	0.629
Clinical					
NYHA Class III/IV, n (%)	117 (90.0)	75 (96.2)	17 (94.4)	25 (73.5)	0.001
Systolic BP (mmHg), mean ± SD	117 ± 27	113 ± 25	129 ± 27	120 ± 29	0.070
Body Mass Index (kg/m²), mean ± SD	25.1 ± 7.2	24.8 ± 7.4	24.1 ± 4.8	26.2 ± 7.9	0.535
Key Aetiologies, n (%)					
Hypertensive Heart Disease	65 (50.0)	32 (41.0)	13 (72.2)	20 (58.8)	-
Peripartum Cardiomyopathy	25 (19.2)	24 (30.8)	1 (5.6)	0 (0.0)	-
Ischaemic Heart Disease	15 (11.5)	10 (12.8)	3 (16.7)	2 (5.9)	-
Rheumatic Heart Disease	10(7.7)	2(2.6)	1(5.6)	7(20.6)	
DCM	10(7.7)	10(12.8)	0	0	
Cor Pulmonale	2(1.5)	0	0	2(5.9)	
Pericardial disease	2(1.5)	0	0	2(5.9)	
RCM	1(0.8)	0	0	1(2.9)	
Echocardiography					
LVEF (%), mean ± SD	38.3 ± 16.9	26.5 ± 6.4	44.2 ± 2.9	62.2 ± 8.6	<0.001
LVEDD (mm), mean ± SD	62.2 ± 12.2	67.4 ± 10.4	60.0 ± 5.6	51.3 ± 11.2	<0.001
E/A ratio, median (IQR)	2.1 (0.63-2.60)	2.4 (1.7-3.0)	1.28 (0.60-2.14)	0.74 (0.47-2.20)	<0.001
E/e' ratio, median (IQR)	11 (8-15)	11 (9-15)	13 (8.8-17.3)	10.5 (7.8-17.8)	0.694
Deceleration Time (ms), mean ± SD	141.1 ± 52.2	117.2 ± 41.0	167.7 ± 46.6	181.7 ± 46.6	<0.001
Comorbidities, n (%)					
Hypertension	77 (59.2)	41 (52.6)	14 (77.8)	22 (64.7)	0.110
Diabetes Mellitus	20 (15.4)	6 (7.7)	6 (33.3)	8 (23.5)	0.008
Atrial Fibrillation/Flutter	17 (13.1)	7 (9.0)	2 (11.1)	8 (23.5)	0.120
Chronic Kidney Disease*	35 (26.9)	13 (16.7)	10 (55.6)	12 (35.3)	0.002
Anaemia†	65 (50.0)	43 (55.1)	6 (33.3)	16 (47.1)	0.230

* Defined as eGFR <60 ml/min/1.73m²; †Defined as PCV <39% (men) and <36% (women). NYHA: New York Heart Association; BP: Blood Pressure; LVEF: Left Ventricular Ejection Fraction; LVEDD: Left Ventricular End-Diastolic Dimension; IQR: Interquartile Range.

NT-proBNP Levels and Diagnostic Sensitivity

The median NT-proBNP level for the entire cohort was 3800.0 pg/mL (IQR: 2900.0 - 4500.0 pg/mL). A critical finding was that all 130 patients (100%) had NT-proBNP levels that exceeded the 2016 ESC diagnostic thresholds for HF (i.e., >125 pg/mL for ambulatory and >300 pg/mL for hospitalized patients). This 100% sensitivity held true for both hospitalized and ambulatory patients. The median NT-proBNP among the 64 inpatients was 3800.0 pg/mL (IQR: 2800-4600) and among the 66 outpatients was 3950.0 pg/mL (IQR: 2900-4475), with no significant difference between these groups (p=0.822).

NT-proBNP Levels Across Heart Failure Phenotypes

The distribution of NT-proBNP levels across the three HF phenotypes is shown in table 2. There was no statistically significant difference in median NT-proBNP levels between patients with HFrEF, HFmrEF, and HFpEF (p=0.461).

- HFrEF: 3900.0 pg/mL (IQR: 3075-4600)
- HFmrEF: 3700.0 pg/mL (IQR: 2275-3700)
- HFpEF: 3850.0 pg/mL (IQR: 2700-4325)

The overlap in NT-proBNP values between the groups was substantial, as illustrated by the wide and overlapping IQRs.

Table 2: NT-proBNP Levels by Heart Failure Phenotype and Patient Status

Group	n	Median NT-proBNP (pg/mL)	IQR	P-value
Overall	130	3800.0	2900.0 - 4500.0	-
By Phenotype				0.461
HFrEF	78	3900.0	3075 - 4600	
HFmrEF	18	3700.0	2275 - 3700	
HFpEF	34	3850.0	2700 - 4325	
By Patient Status				0.822
Inpatient	64	3800.0	2800 - 4600	
Outpatient	66	3950.0	2900 - 4475	

IQR: Interquartile Range.

Discussion

This study provides an analysis of NT-proBNP utility in a prospective, well-characterized SSA HF cohort diagnosed using contemporary ESC criteria. The two principal findings are: first, NT-proBNP demonstrated 100% sensitivity for confirming the diagnosis of HF, with every single patient exceeding the recommended ESC cut-off values. Second, and more notably, there was no significant gradient in NT-proBNP levels across the HF phenotypic spectrum, with HFpEF patients displaying similarly markedly elevated levels as those with HFrEF. These findings partially aligns with and extends observations from a previous Nigerian study by Karaye et al., which reported elevated BNP in HF patients but did not perform a formal statistical comparison across EF-based phenotypes.[13]

The exceptional sensitivity of NT-proBNP in this cohort is striking. International guidelines, while affirming the high diagnostic accuracy of NPs, do not claim 100% sensitivity.[6,15] Studies like the PRIDE study found that using an NT-proBNP cut-off of 450 pg/mL for patients aged <50 years and 900 pg/mL for those ≥50 years had a sensitivity of 90% for diagnosing acute HF.[16] However, the cut off used in our patients is lower following the recommended ESC guidelines.[6]The universal elevation in our patients suggests a population presenting with a high degree of myocardial stress and clinical severity. This is corroborated by the fact that 90% of our patients were in NYHA functional class III or IV, indicating advanced symptomatic status. The median NT-proBNP level of 3800 pg/mL in our study is substantially higher than levels reported in Western HF registries and clinical trials for both HFrEF and HFpEF.[17,18]It also appears higher than median levels described in some broader African studies like the INTER-CHF study.[9] This likely reflects late presentation and diagnosis in our setting, where patients often endure symptoms for prolonged periods before accessing tertiary care. The lack of a significant difference between inpatients and outpatients further suggests that even those managed ambulatorily in this context have severe, decompensated disease.

The absence of a significant difference in NT-proBNP levels between HFrEF, HFmrEF, and HFpEF is a key finding that contrasts with the established literature. Numerous studies have consistently shown that NP levels are higher in HFrEF than in HFpEF.[10,11,19] The proposed mechanism is that the dilated, thin-walled ventricle in HFrEF experiences greater wall stress according to the Law of Laplace, providing a stronger stimulus for NP secretion than the thick-walled, small-cavity ventricle typical of HFpEF.[12] Our results challenge the universal applicability of this pathophysiological model in this SSA population.

Several factors may explain this discrepancy. First, the overwhelming burden of comorbidities in our cohort, particularly hypertension, may be a major driver of NP release irrespective of LVEF. Chronic pressure overload leads to left ventricular hypertrophy and fibrosis, which are potent stimuli for NP synthesis.[20] In our study, hypertension was highly prevalent across all phenotypes (52.6% in HFrEF to 77.8% in HFmrEF). The sustained high-pressure load in a hypertrophied heart, even with preserved EF, could generate sufficient wall stress to produce NT-proBNP levels comparable to those seen in systolic failure.

Second, the aetiological profile is different. The high prevalence of peripartum cardiomyopathy (PPCM) in our HFrEF group (30.8%) is distinctive. PPCM is an acute or subacute form of HF, and the intense inflammatory and cytotoxic myocardial injury involved may lead to a different pattern of biomarker release compared to chronic ischaemic or idiopathic dilated cardiomyopathy [21]. Furthermore, the significant burden of rheumatic heart disease (RHD) in the HFpEF group (20.6%), where pressure or volume overload from regurgitant or stenotic lesions directly increases atrial and ventricular strain, potently stimulating NP secretion. [22]

Third, the role of renal function must be considered. Renal impairment reduces the clearance of NT-proBNP, leading to its accumulation [7]. In our cohort, chronic kidney disease (eGFR <60 ml/min/1.73m²) was present in 26.9% of patients and was most prevalent in the HFmrEF group (55.6%). This could have contributed to the elevated levels across the board and potentially minimized inter-phenotype differences.

Fourth, the relative lack of obesity in our cohort may be a factor. Obesity is known to suppress NP levels, a phenomenon often attributed to increased NP clearance receptors in adipose tissue or reduced synthesis.[8,23] The mean BMI in our cohort was 25.1 kg/m², with only 18.5% being obese (BMI ≥30 kg/m²). This is lower than the prevalence of obesity in many Western HFpEF cohorts, where it often exceeds 50%.[24] The absence of this suppressing effect in our population may allow the "true" myocardial wall stress to be more fully reflected in the circulating NT-proBNP levels, unmasking the severe pathophysiological burden even in HFpEF.

Implications for Clinical Practice and Laboratory Medicine

From a diagnostic perspective, our findings robustly validate the use of NT-proBNP as a rule-*out* test in this population. A normal NT-proBNP level in a patient with suspected HF would make the diagnosis highly unlikely. However, the lack of discriminatory power between phenotypes means that clinicians cannot use the absolute NT-proBNP value to infer whether a patient has reduced or preserved EF. This places greater emphasis on the necessity of echocardiography for phenotyping all HF patients in SSA, as treatment strategies differ significantly. For the clinical laboratory, this study confirms the reliability and high clinical sensitivity of the NT-proBNP ELISA assay in a real-world SSA setting.

Study Limitations

This study has limitations. It is a single-centre study, which may affect generalizability, though it provides a detailed view from a major referral centre. We did not have a control group of asymptomatic individuals to define a true reference range or calculate specificity. The study was not powered to examine the complex multivariate relationships between NT-proBNP, phenotypes, and comorbidities like renal function in depth

Conclusion

In this SSA HF cohort, NT-proBNP proved to be an exceptionally sensitive biomarker for confirming the diagnosis of heart failure, with 100% of patients exceeding the ESC-recommended diagnostic thresholds. This underscores its critical value in the diagnostic algorithm. However, unlike in many other populations, NT-proBNP levels were uniformly and markedly elevated across all HF phenotypes, showing no significant gradient from HFrEF to HFpEF. This suggests that the pathophysiology driving NP release in this population may be different, potentially related to a high burden of hypertensive heart disease, unique aetiologies, and late presentation. Consequently, while NT-proBNP is indispensable for diagnosing HF, it cannot be used to distinguish between phenotypic subtypes in this context, mandating universal access to echocardiography for appropriate management.

References

24 sources

1 Damasceno A, Mayosi BM, Sani M, Ogah OS, Mondo C, Ojji D, et al. The causes, treatment, and outcome of acute heart failure in 1006 Africans from 9 countries: Results of the sub-Saharan Africa survey of heart failure. Arch Intern Med. 2012;172(18):1386-94.

2 Bloomfield GS, Barasa FA, Doll JA, Velazquez EJ. Heart failure in sub-Saharan Africa. Curr Cardiol Rev. 2013;9(2):157-73.

3 Kelder JC, Cramer MJ, van Wijngaarden J, van Tooren R, Mosterd A, Moons KGM, et al. The diagnostic value of physical examination and additional testing in primary care patients with suspected heart failure. Circulation. 2011;124(25):2865-73.

4 Maisel AS, Krishnaswamy P, Nowak RM, McCord J, Hollander JE, Duc P, et al. Rapid measurement of B-type natriuretic peptide in the emergency diagnosis of heart failure. N Engl J Med. 2002;347(3):161-7.

5 Daniels LB, Maisel AS. Natriuretic peptides. J Am Coll Cardiol. 2007;50(25):2357-68.

6 Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JGF, Coats AJS, et al. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. Eur Heart J. 2016;37(27):2129-200.

7 Bettencourt P. NT-proBNP and BNP: biomarkers for heart failure management. Eur J Heart Fail. 2004;6(3):359-63.

8 Mehra MR, Uber PA, Park MH, Scott RL, Ventura HO, Harris BC, et al. Obesity and suppressed B-type natriuretic peptide levels in heart failure. J Am Coll Cardiol. 2004;43(9):1590-5.

9 Dokainish H, Teo K, Zhu J, Roy A, AlHabib KF, ElSayed A, et al. Heart Failure in Africa, Asia, the Middle East and South America: The INTER-CHF study. Int J Cardiol. 2016;204:133-41.

10 Lubien E, DeMaria A, Krishnaswamy P, Clopton P, Koon J, Kazanegra R, et al. Utility of B-natriuretic peptide in detecting diastolic dysfunction: comparison with Doppler velocity recordings. Circulation. 2002;105(5):595-601.

11 Tschöpe C, Kasner M, Westermann D, Gaub R, Poller WC, Schultheiss HP. The role of NT-proBNP in the diagnostics of isolated diastolic dysfunction: correlation with echocardiographic and invasive measurements. Eur Heart J. 2005;26(21):2277-84.

12 Iwanaga Y, Nishi I, Furuichi S, Noguchi T, Sase K, Kihara Y, et al. B-type natriuretic peptide strongly reflects diastolic wall stress in patients with chronic heart failure. J Am Coll Cardiol. 2006;47(4):742-8.

13 Karaye K, Saidu H, Yahaya I, Bala M. Prevalence, clinical characteristics and outcome of pulmonary hypertension among admitted heart failure patients. Ann Afr Med. 2013;12(4):197-204.

14 Lang RM, Badano LP, Mor-Avi V, Afilalo J, Armstrong A, Ernande L, et al. Recommendations for cardiac chamber quantification by echocardiography in adults: an update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. Eur Heart J Cardiovasc Imaging. 2015;16(3):233-70.

15 Yancy CW, Jessup M, Bozkurt B, Butler J, Casey DE, Colvin MM, et al. 2017 ACC/AHA/HFSA Focused Update of the 2013 ACCF/AHA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Failure Society of America. Circulation. 2017;136(6):e137-e161.

16 Januzzi JL, Camargo CA, Anwaruddin S, Baggish AL, Chen AA, Krauser DG, et al. The N-terminal Pro-BNP investigation of dyspnea in the emergency department (PRIDE) study. Am J Cardiol. 2005;95(8):948-54.

17 McMurray JJ, Packer M, Desai AS, Gong J, Lefkowitz MP, Rizkala AR, et al. Angiotensin-neprilysin inhibition versus enalapril in heart failure. N Engl J Med. 2014;371(11):993-1004.

18 Solomon SD, Rizkala AR, Gong J, Wang W, Anand IS, Ge J, et al. Angiotensin Receptor Neprilysin Inhibition in Heart Failure with Preserved Ejection Fraction: Rationale and Design of the PARAGON-HF Trial. JACC Heart Fail. 2017;5(7):471-82.

19 Masson S, Latini R, Anand IS, Barlera S, Angelici L, Vago T, et al. Direct comparison of B-type natriuretic peptide (BNP) and amino-terminal proBNP in a large population of patients with chronic and symptomatic heart failure: the Valsartan Heart Failure (Val-HeFT) data. Clin Chem. 2006;52(8):1528-38.

20 Kerkelä R, Ulvila J, Magga J. Natriuretic Peptides in the Regulation of Cardiovascular Physiology and Metabolic Events. J Am Heart Assoc. 2015;4(10):e002423.

21 Sliwa K, Hilfiker-Kleiner D, Petrie MC, Mebazaa A, Pieske B, Buchmann E, et al. Current state of knowledge on aetiology, diagnosis, management, and therapy of peripartum cardiomyopathy: a position statement from the Heart Failure Association of the European Society of Cardiology Working Group on peripartum cardiomyopathy. Eur J Heart Fail. 2010;12(8):767-78.

22 Gerber IL, Stewart RA, Legget ME, West TM, French RL, Sutton TM, et al. Increased plasma natriuretic peptide levels reflect symptom onset in aortic stenosis. Circulation. 2003;107(14):1884-90.

23 Wang TJ, Larson MG, Levy D, Benjamin EJ, Leip EP, Wilson PW, et al. Impact of obesity on plasma natriuretic peptide levels. Circulation. 2004;109(5):594-600.

24 Shah SJ, Kitzman DW, Borlaug BA, van Heerebeek L, Zile MR, Kass DA, et al. Phenotype-specific treatment of heart failure with preserved ejection fraction: a multiorgan roadmap. Circulation. 2016;134(1):73-90.

HOW TO CITE

Haruna Abubakar Alhaji, Ayoola Yekeen Ayodele, Hussain Muhammad Sulaiman, Babalawan Muhammad, Kabir Abdussalam, Mohammed Fatima Isa. Utility of NT-proBNP in the Diagnosis of Heart Failure Phenotypes in a Sub-Saharan African Population. *Delta Oghara Medical Journal*. 2026;2(1).

https://domj.org/index.php/start/article/view/utility-nt-probnp-diagnosis-heart-failure-phenotypes-sub-saharan-african-population

Scan to view article