Community-Based Assessment of Knowledge and Perception of Blood Genotype and Sickle Cell Disease among Pupils in Lafia LGA, Nasarawa State.

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ABSTRACT

Background: Sickle cell disease (SCD) remains a major public health challenge globally. Nigeria accounts for the largest number of SCD cases worldwide, with over 150,000 affected births annually. Adequate knowledge of blood genotype and SCD is essential for informed reproductive decision-making and prevention of the disease. This study assessed the knowledge and perception of blood genotype and sickle cell disease among pupils in Lafia LGA, Nasarawa State, Nigeria.

Methods: A descriptive cross-sectional study was conducted among 417 pupils aged 10–18 years selected from primary and junior secondary schools in Lafia LGA. The participants were selected using a multistage sampling technique. Data were collected using a structured, validated questionnaire developed using the adopt–adapt approach. Descriptive statistics were used to summarize the data, while Chi-square analysis was used to determine associations between socio-demographic characteristics and knowledge of blood genotype and sickle cell disease at a 5% level of significance.

Results: The findings revealed that 82.3% of respondents were aware of blood genotype. School was the major source of information (36.0%), followed by parents/guardians (17.3%) and social media (12.9%). More than half of the respondents (59.5%) reported knowing their genotype, with AA genotype being the most common (47.2%). Good knowledge of blood genotype and sickle cell disease was observed among 53.7% and 55.6% of respondents, respectively. Pupils demonstrated a generally positive perception of blood genotype and sickle cell disease, with mean perception scores above the decision point of 3.0 for most items. However, misconceptions regarding the spiritual origin of sickle cell disease persisted among some respondents. No statistically significant association was found between age, sex, class, religion, ethnicity, parental educational level and knowledge of blood genotype and sickle cell disease ($p > 0.05$).

Conclusion: Awareness, knowledge, and perception of blood genotype and sickle cell disease among pupils in Lafia LGA were generally satisfactory. Nevertheless, few of the pupils remained unaware of their genotype and some misconceptions about the disease persisted. The study recommended strengthening school-based health education, expanding access to genotype testing, and implementing continuous community sensitization programmes to improve genotype awareness and contribute to the prevention of sickle cell disease.

Keywords: Blood genotype, sickle cell disease, knowledge, perception, pupils, awareness.

INTRODUCTION

Sickle cell disease (SCD) remains one of the most prevalent and genetically inherited haemoglobin disorders globally (Kavanagh *et al.,* 2022; Tebbi, 2022). It is characterized by a disorder in hemoglobin (HbS) resulting

from a point mutation in the β-globin gene (Brown *et al.,* 2022; Uche *et al.,* 2017). This mutation involves the substitution of glutamic acid with valine at the sixth position of the hemoglobin chain (Uche *et al.* 2017). This substitution leads to the production of abnormal hemoglobin known as hemoglobin S (HbS) (WHO, 2025). This abnormal hemoglobin is less soluble than normal hemoglobin and causes red blood cells to assume a rigid, sickle shape under low oxygen conditions (Uche *et al.,* 2017; Tebbi, 2022). Sickle Cell Disease is one of the most common monogenic diseases globally. The disease is most prevalent in Sub-Saharan Africa, the Middle East, and parts of the Mediterranean region (Oluwole *et al.,* 2018; WHO, 2018; Uche *et al.,* 2017). It is estimated that approximately 401,000 infants are born each year with the disease worldwide (World Health Organization, 2020; Ebele Uche *et al.,* 2017; Oluwole *et al.,* 2018). Statistics have shown that about 70 – 75% of those cases are found in sub-Saharan Africa (SSA) (Piel *et al.,* 2013; Makani *et al.,* 2013: Brown *et al.,* 2022). Mortality for SCD in Africa remains as high as 50 to 90 percent, with less than half of affected children reaching their fifth birthday (Akodu *et al.,* 2013; Oluwole *et al.,* 2018; Piel *et al.,* 2013; Brown *et al.,* 2022). The distribution of SCD is closely linked to regions historically affected by malaria, as the sickle cell trait (AS genotype) offers partial protection against severe malaria (Kiyaga, 2024; Abah *et al.,* 2025). Consequently, countries in Sub-Saharan Africa, particularly Nigeria, account for the highest number of cases globally. Other affected regions include parts of India, the Middle East, and Southern Europe (Adewoyin et al., 2015).

Nigeria bears the greatest burden of SCD worldwide, with approximately 20–30% of the population carrying the sickle cell trait and about 2–3% living with the disease. It is estimated that over 150,000 babies are born annually with SCD in Nigeria. Majority of the babies do not survive beyond the age of five due to complications associated with the condition (Uche *et al.,* 2017; Oluwole *et al.,* 2018; Brown *et al.,* 2022). It has been estimated that in the absence of effective and sustainable control strategies of the disease, the figure will increase by 100% by 2050 (Piel *et al.,* 2013; Inusa *et al.,* 2015; Oluwole *et al.,* 2018). Pathophysiologically, SCD is characterized by the polymerization of hemoglobin S under low oxygen tension, leading to the distortion of red blood cells into a sickle shape. These abnormal cells are rigid and adhesive, causing blockage of small blood vessels, reduced oxygen delivery to tissues, and recurrent episodes of pain known as vaso-occlusive crises. Additionally, the rapid destruction of sickled red blood cells results in chronic anemia (Adewoyin *et al.,* 2015; Moumni *et al.,* 2016).

SCD is preventable through informed reproductive choices (Brown *et al.,* 2022). These choices are grounded in adequate knowledge of blood genotype compatibility (Uche *et al.,* 2017; Chukwurah *et al.,* 2019; Oluwole *et al.,* 2018). Blood genotype awareness is fundamental in preventing the birth of children with sickle cell disease (Uche *et al.,* 2017). Studies in Nigeria have consistently shown that awareness of SCD is relatively high among adolescents and young adults. However, adequate knowledge of genotype compatibility and its implications remains inadequate (Oluwole *et al.,* 2018; Uche *et al.,* 2017; Brown *et al.,* 2022: Faremi *et al.,* 2018; Imam-Fulani, 2024). Lafia local government area of Nasarawa State shares similar demographic and epidemiological characteristics with other parts of Nor-central Nigeria. Despite the known burden of SCD in Nigeria, there is a paucity of studies on pupils' knowledge and perception of blood genotype and sickle cell disease in Lafia. Existing studies have largely focused on tertiary institutions or adolescent living in urban regions, leaving a significant gap in understanding younger, school-based populations in the community. This study therefore seeks to fill this gap by assessing the knowledge and perceptions of pupils toward blood genotype and sickle cell disease in Lafia LGA, Nasarawa State.

MATERIALS AND METHODS

Research Design

This a descriptive cross-sectional study conducted among pupils in Lafia LGA, Nasarawa State. This research design is considered appropriate because the researcher can used it to assess the knowledge and perception of blood genotype and sickle cell disease among pupils at a specific point in time without manipulating any study variables (Kesmodel, 2018; Wang and Cheng, 2020). The design is suitable for obtaining information on existing conditions, beliefs, attitudes, and levels of awareness within a defined population (Cvetkovic-Vega *et al.,* 2021). It also facilitates the collection of quantitative data from a relatively large number of respondents (Alexander *et al.,* 2015).

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Study Area

The study was conducted in Lafia Local Government Area (LGA) of Nasarawa State, Nigeria. Lafia is the capital city of Nasarawa State (Agidi, 2025). It also doubles as the administrative, commercial and educational centre of the state. Lafia town is situated on Longitudes 08º 30¹ East and Latitude 08 º 31¹ north. It shares boundaries with several local government areas including Doma, Obi, Keana, and Awe (Magaji *et al.,* 2025). According to the most recent population estimates, Lafia is one of the most populous LGAs in Nasarawa State.The inhabitants of Lafia engage predominantly in farming, trading, civil service, and small-scale business activities. The area is inhabited by the Kanuri, Fulani Gwandara, Alago, Migilli (Koro) (Obadiah and Haruna, 2025). It also has large populations of Hausa. Lafia is home to several tertiary institutions (Obadiah and Daniel, 2013). It also has a large number of primary and secondary schools. This makes Lafia suitable for studies involving school-aged children and adolescents.

Study Population

The study population consisted of pupils aged 10 to 18 years in Lafia LGA of Nasarawa State, Nigeria. The population included pupils attending upper primary (primary 4-6) and junior secondary schools (JSS 1-3) in the study area. These pupils were selected because they are capable of understanding and responding to questions related to health, genetics, blood genotype, and sickle cell disease.

Sample Size Determination

The sample size for this study was determined using the Cochran formula for calculating sample size in proportion-based studies (Whicker *et al.,* 2006; Ahmed, 2024; Yang *et al.,* 2022). This formula is appropriate when the population is large and the prevalence of the variable of interest is known or estimated (Yang *et al.,* 2022). The formula is given as:

$n = (z^2pq/d^2)$

Where:

n= the desired minimum sample size.

Z = Z-score for the desired confidence level (1.96 for a 95% confidence level)

P = Level of Knowledge from previous studies (86.7% = 0.867) (Imam-Fulani, 2024)

Q = Complementary probabilities [q = (1-P) =1-0.867 = 0.133)].

D = degree of accuracy desired (usually set at 5% or 0.05)

Substituting the values, the sample size can be calculated thus:

$$n = \frac{(1.96)^2 \times (0.56)\ (0.44)}{(0.05)^2}$$

$$n = \frac{1.0.9466}{0.0025}$$

n = 378.63

If a 10% allowance for non-response rate is added, the sample size of the study population will be = 379 × 0.10 = 37.9

= 379 + 38 = 417

Therefore, population of study is approximately 417

Sampling Technique

A multistage sampling technique was employed. In the first stage, selected schools were chosen through simple random sampling from the list of registered schools obtained from the Local Government Education Authority. In the second stage, eligible classes (Primary 5, Primary 6, JSS1, JSS2, and JSS3) were identified in each selected school. In the final stage, pupils aged 10–18 years were selected from class registers using simple random sampling until the required sample size of 417 was obtained.

Inclusion and Exclusion Criteria

Pupils eligible for inclusion were those enrolled in selected primary and junior secondary schools in Lafia LGA, specifically Primary 5, Primary 6, JSS1, JSS2, and JSS3, whose parents or guardians provide consent and who provide assent to participate. Pupils absent during data collection, those without parental or guardian consent, those who decline participation, and those who submit incomplete questionnaires will be excluded from the study.

Instrument of Data Collection

Data was collected using a well-structured questionnaire developed using the adopt–adapt approach. Relevant items were adopted from previously validated studies on blood genotype and sickle cell disease and adapted to suit the study population. The adopted items were adapted to suit the age, educational level, and comprehension ability of primary and junior secondary school pupils. Technical terms were simplified for clarity. Context-specific questions relevant to the study area were included, while irrelevant items were excluded. The questionnaire was organized into four sections. Section A elicited socio-demographic characteristics of the respondents. Section B assessed knowledge of blood genotype. Section C assessed knowledge of sickle cell disease, while Section D assessed respondents' perceptions of blood genotype and sickle cell disease.

The knowledge sections used binary (Yes/No) questions, scored as 1 for correct and 0 for incorrect responses. A composite knowledge score was generated and categorized as poor (<50%), fair (50–69%), and good (≥70%). Perception was measured using a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). A mean score of 3.0 and above indicated a positive perception, while a mean score below 3.0 indicated a negative perception.

Validity and Reliability of the Instrument

Content validity was ensured through expert review by two epidemiologists and one public health researcher. Face validity was established via a pilot test involving 50 pupils in schools outside the study area but with similar characteristics.

For reliability, Cronbach's alpha was computed for internal consistency. A coefficient of 0.84 was obtained, indicating an acceptable level of reliability (Knapp and Mueller, 2010; Mazhar *et al.,* 2021; Mazhar *et al.,* 2025).

Method of Data Collection

Prior to data collection, the researcher obtained ethical approval from relevant authorities. Once approvals were granted, the researcher and trained research assistants visited selected schools for data collection. Permission was obtained from the school authorities before administration of the questionnaires. Data were collected over a three-week period by trained research assistants under the supervision of the principal investigator. Respondents were briefed on the purpose of the study and assured of confidentiality. Questionnaires were administered and retrieved immediately after completion to reduce loss and non-response rate.

Method of Data Analysis

Collected data were coded and entered into Statistical Package for the Social Sciences (SPSS) version 25 for analysis. Descriptive statistics such as frequencies, means, and standard deviations were used to summarize the

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data. Inferential statistics including chi-square tests was used to examine associations between variables. A p-value less than 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from Nasarawa State Ministry of Health before the commencement of the study. Permission to administer questionnaire was also obtained from Nasarawa State Ministry of Education, Local Government Education Authority, School administrators. Informed consent was sought from parent/guardians and participants before data collection. Confidentiality and anonymity were strictly maintained. Participation was entirely voluntarily, and respondents were free to withdraw at any stage without penalty. Information obtained from respondents were securely stored and used strictly for research purposes, in accordance with the Declaration of Helsinki.

RESULTS

Table 1: Socio-demographic Information of Respondents

Variables	Frequency (417)	Percentage (%)
Sex		
Male	217	52.0
Female	200	48.0
Age		
10–12 years	171	41.0
13–15 years	189	45.3
16 years and above	57	13.7
Class		
Primary 4	45	10.8
Primary 5	76	18.2
Primary 6	73	17.5
JSS1	72	17.3
JSS2	83	19.9
JSS3	68	16.3
School Type		
Public	293	70.3
Private	124	29.7
Religion		
Christianity	166	39.8
Islam	236	56.6
Traditional Religion	8	1.9
Others	7	1.7
Ethnic Group		
Alago	136	32.6
Eggon	77	18.5
Hausa	90	21.6
Tiv	51	12.2
Fulani	33	7.9
Others	30	7.2
Parental Educational Level		
No Formal Education	37	8.9
Primary Education	78	18.7
Secondary Education	168	40.3
Tertiary Education	134	32.1

Source: Field Survey (2026)

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Table 1 shows the socio-demographic profile of the respondents. Results of the study showed that majority of the respondents were male (52.0%) who were within the age range of 13–15 years age range (45.3%). This was followed by those aged 10–12 years (41.0%). Most of the respondents were in JSS2 (19.9%), followed by Primary 5 (18.2%), Primary 6 (17.5%), and JSS1 (17.3%). Majority attended public schools (70.3%), while 29.7% attended private schools. Most respondents practiced Islam (56.6%), while 39.8% practiced Christianity. Ethnically, the Alago group constituted the largest proportion (32.6%), followed by Hausa (21.6%) and Eggon (18.5%). In terms of parental/guardian educational level, most respondents had parents with secondary education (40.3%), followed by tertiary education (32.1%), while only 8.9% had parents with no formal education.

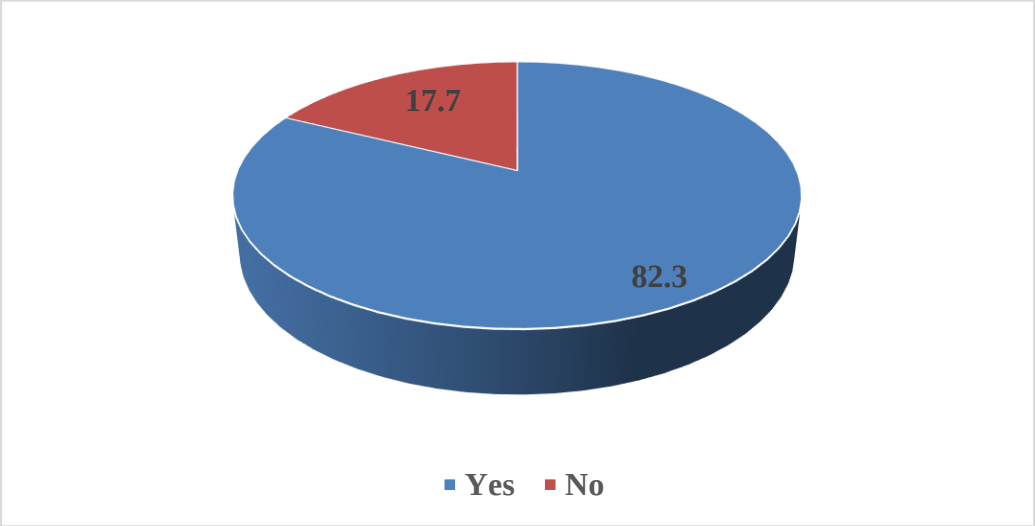

Figure 1: Awareness of Blood Genotype among Respondents

Presented in Figure 1 is respondents awareness of blood gentoptye. The findings revealed that 82.3% of the respondents were aware of blood genotype while 17.7% were not aware of blood genotype. This finding shows that majority of the respondents were aware of blood genotype.

Table 2: Awareness of Blood Genotype Among Respondents

Variables	Frequency (417)	Percentage (%)
Source of Information		
School	150	36.0
Parent/Guardian	72	17.3
Health worker	48	11.5
Television/Radio	42	10.1
Social media	54	12.9
Friends	33	7.9
Others	18	4.3
Knowledge of Own Genotype		
Yes	248	59.5
No	169	40.5
Genotype		
AA	197	47.2
AS	48	11.5
SS	1	0.2
AC	2	0.5
Don’t Know	169	40.5

Source: Field Survey (2026)

Table 2 shows the awareness of blood genotype among respondents. The findings show that school was the most frequent source of information (36.0%), followed by parents/guardians (17.3%), social media (12.9%), health workers (11.5%), television/radio (10.1%), friends (7.9%), and other sources (4.3%). Regarding knowledge of own genotype, most of respondents (59.5%) reported that they knew their genotype, while 40.5% indicated that they did not. Almost half of the respondents were AA (47.2%), followed by AS (11.5%), while very few were AC (0.5%) and SS (0.2%). However, close to half (40.5%) of the respondents did not know their genotype.

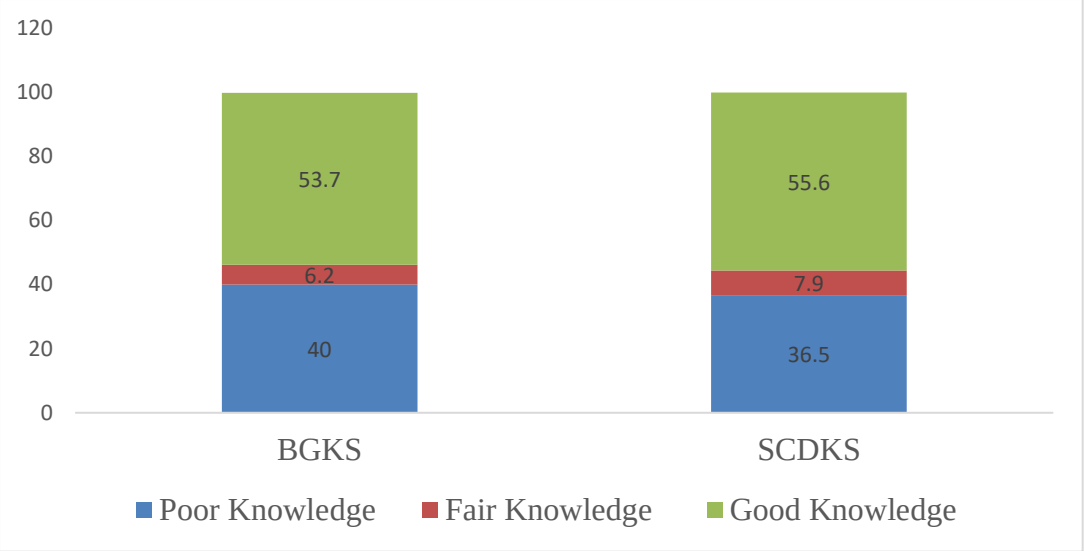

Figure 2: Knowledge of Blood Genotype and Sickle Cell Disease

Figure 2 shows the knowledge of blood genotype and sickle cell disease in Lafia. The results showed that more than half of the respondents had good knowledge of both blood genotype (53.7%) and sickle cell disease (55.6%). However, 40.0% and 36.5% of the respondents had poor knowledge of blood genotype and sickle cell disease respectively. Few of the respondents demonstrated fair knowledge of blood genotype (6.2%) and sickle cell disease (7.9%). The findings shows that respondents generally possessed good knowledge, with slightly better knowledge of sickle cell disease than blood genotype.

Table 3: Perception of Blood Genotype and Sickle Cell Disease (n = 417)

S/N	Statement	SA	A	U	D	SD	Mean ± SD
1	Every pupil should know his or her genotype.	78	93	70	107	69	3.01 ± 1.376
2	Genotype testing is important before marriage.	82	86	83	101	65	3.05 ± 1.364
3	Schools should teach pupils about blood genotype and sickle cell disease.	83	90	66	110	68	3.02 ± 1.390
4	People with sickle cell disease should be treated with respect.	79	96	71	103	68	3.04 ± 1.375
5	I would like to know my genotype if I do not already know it.	87	82	74	108	66	3.04 ± 1.388
6	Sickle cell disease can be prevented through awareness and education.	83	81	85	95	73	3.01 ± 1.387
7	I am interested in learning more about blood genotype.	84	92	75	103	63	3.07 ± 1.370
8	People with sickle cell disease should not be discriminated against.	89	80	75	98	75	3.02 ± 1.416
9	Parents should encourage their children to know their genotype.	80	89	75	99	74	3.00 ± 1.390
10	Knowledge of genotype can help prevent sickle cell disease in future generations.	87	93	75	100	62	3.10 ± 1.373

11	Sickle cell disease is a spiritual problem	73	76	74	124	70	2.90 ± 1.359
12	I would be willing to marry someone with AS genotype	83	82	84	96	72	3.02 ± 1.385

Source: Field Survey (2026)

Presented in Table 3 is pupils' perception of blood genotype and sickle cell disease in Lafia LGA. Result of the study showed that item 1–12 had mean scores of 3.01, 3.05, 3.02, 3.04, 3.04, 3.01, 3.07, 3.02, 3.00, 3.10 and 3.02 respectively. Since the mean scores are above the decision point of 3.0, it implies that pupils had a moderate to positive perception of blood genotype and sickle cell disease. The positive perceptions include the importance of genotype knowledge, genotype testing before marriage, school-based education on sickle cell disease, respect for affected individuals, and willingness to learn more about genotype. However, item 11 had a mean score below the decision point. This result shows the persistence of some misconception that sickle cell disease is spiritual in origin.

Table 4: Relationship between Sociodemographic Characteristics and Knowledge Blood Genotype and Sickle Cell Disease.

	Knowledge			**χ^2**	**P-Value**
Sociodemographic Characteristics	**Poor (%)**	**Fair (%)**	**Good (%)**		
Age					
10–12 years	59 (34.5)	15 (8.8)	97 (56.7)	1.752	0.781
13–15 years	73 (38.6)	12 (6.3)	104 (55.0)		
16 years and above	20 (35.1)	6 (10.5)	31 (54.4)		
Sex					
Male	75 (34.6)	16 (7.4)	126 (58.1)	1.090	0.580
Female	77 (38.5)	17 (8.5)	106 (53.0)		
Class					
Primary 4	18 (40.0)	3 (6.7)	24 (53.3)	13.335	0.206
Primary 5	31 (40.8)	5 (6.6)	40 (52.6)		
Primary 6	31 (42.5)	2 (2.7)	40 (54.8)		
JSS1	22 (30.6)	11 (15.3)	39 (54.2)		
JSS2	27 (32.5)	4 (4.8)	52 (62.7)		
JSS3	23 (33.8)	8 (11.8)	37 (54.4)		
Religion					
Christianity	77 (32.6)	18 (7.6)	141 (59.7)	8.239	0.221
Islam	70 (42.2)	13 (7.8)	83 (50.0)		
Traditional	1 (12.5)	1 (12.5)	6 (75.0)		
Others	4 (57.1)	1 (14.3)	2 (28.6)		
Ethnic Group					
Alago	48 (35.3)	13 (9.6)	75 (55.1)	11.225	0.340
Eggon	34 (44.2)	5 (6.5)	38 (49.4)		
Hausa	27 (30.0)	9 (10.0)	54 (60.0)		
Tiv	15 (29.4)	3 (5.9)	33 (64.7)		
Fulani	17 (51.5)	0 (0.0)	16 (48.5)		
Others	11 (36.7)	3 (10.0)	16 (53.3)		
Parent Education					
No formal education	8 (21.6)	6 (16.2)	23 (62.2)	10.059	0.122
Primary	24 (30.8)	6 (7.7)	48 (61.5)		
Secondary	69 (41.1)	14 (8.3)	85 (50.6)		
Tertiary	51 (38.1)	7 (5.2)	76 (56.7)		

Source: Field Survey, 2025

Table 5 presents the relationship between socio-demographic characteristics and knowledge of blood genotype and sickle cell disease among pupils in Lafia LGA, Nasarawa State. The results revealed that males (58.1%) had higher good knowledge compared to females (53.0%). Good knowledge was relatively consistent across age groups, with pupils aged 10–12 years (56.7%), 13–15 years (55.0%), and 16 years and above (54.4%). JSS2 pupils (62.7%) recorded the highest percentage of good knowledge, followed by Primary 6 (54.8%) and JSS1 (54.2%). Similarly, pupils from Tiv ethnic group (64.7%) and Hausa group (60.0%) showed relatively higher good knowledge compared to other groups. In terms of religion, traditional worshippers (75.0%) recorded the highest good knowledge, followed by Christians (59.7%) and Muslims (50.0%). Pupils whose parents had primary education (61.5%) demonstrated slightly higher good knowledge compared to other educational categories. Statistical analysis showed that there was no significant association between age, sex, class, religion, ethnicity, parental education and knowledge of blood genotype and sickle cell disease ($p > 0.05$).

DISCUSSION

This study examined the knowledge and perception of blood genotype and sickle cell disease among pupils in Lafia LGA, Nasarawa State, Nigeria. Result of the study showed that majority (82.3%) of the respondents were aware of blood genotype. This indicates a high level of awareness among pupils on blood genotype and sickle cell disease. The finding agrees with Olakunle *et al.* (2013) who reported that 83.2% of the respondents were aware of sickle cell disease. It also aligns with the findings of Owolabi *et al.* (2011), who found that 81.8% of secondary school students in Abuja had heard about sickle cell disease. Ezenwosu *et al.* (2021) reported that a majority of respondents (94%) were aware of their genotype, while Boadu (2018), Brown *et al.* (2022), Shuaibu (2019), Adegbite (2021), Adamu (2026), Maboulou *et al.* (2022), and Afolabi *et al.* (2024) all reported very high levels of awareness of sickle cell disease among students and young people. The finding also corresponds with Osonuga *et al*. (2025). They found that most undergraduate students were aware of premarital genetic counselling and sickle cell disease prevention.

However, the finding is higher than that reported by Oluwadamilola *et al*. (2021), who found that only 58.5% of students were aware of sickle cell disease. It is also higher than Oluwole *et al.* (2018), who reported awareness of 64.9% among secondary school students in Lagos State. The higher awareness observed in the present study may be attributed to increased public health campaigns, school-based health education programmes, greater exposure to social media platforms, and growing emphasis on genotype testing in Nigerian communities. Schools in Lafia may also have incorporated health education activities that have improved awareness among pupils.

The study further revealed that school was the most common source of information on blood genotype and sickle cell disease (36.0%), followed by parents or guardians (17.3%), social media (12.9%), health workers (11.5%), and television or radio (10.1%). This finding agrees with Boadu (2018), who reported that school was the major source of information on sickle cell disease. It also corroborates Brown *et al.* (2022), who found that school and the media were the primary sources of information among undergraduate students. It is also in consonant with Agbozo *et al.* (2023) who reported that school and social media significantly influenced knowledge of sickle cell disease. However, Ezenwosu *et al.* (2015) identified radio and community information channels as important sources of awareness. The agreement may be attributed to the important role educational institutions play in disseminating health information to young people. Schools provide a structured environment where health education can easily be incorporated into academic activities.

The findings of the study showed that 59.5% of the respondents knew their genotype, while 40.5% did not know their genotype. This finding agrees with Imam-Fulani *et al.* (2024) who found that 56% of respondents knew their haemoglobin genotype. It also agrees with Olakunle *et al.* (2013) who reported that 59% of students knew their genotype. This finding of the study is also in consonant with Bazuaye and Olayemi (2009), who reported that 32% of secondary school students knew their genotype. It also corroborates the report of Ngwengi *et al.* (2020), who found that 13.2% of youths knew their genotype. This finding also agrees with Musa (2016), who reported that 71% of nursing students knew their genotype, and Ezenwosu *et al.* (2021), where 94% of respondents were aware of their genotype.

However, this finding disagrees with Faremi *et al.* (2018), who reported that a good number of respondents did not know their genotype. It also disagrees with the report of Adamu (2026) who found that 61.6% of respondents had not undergone genotype testing despite being aware of sickle cell disease. The higher percentage of pupils who knew their genotype in the present study compared to some previous studies may be due to increased access to genotype testing services. It might also be attributed to the growing awareness campaigns. The lower percentage compared to university-based studies may be explained by differences in educational level, maturity, and access to health services.

The study revealed that 53.7% of the respondents had good knowledge of blood genotype while 55.6% had good knowledge of sickle cell disease. This finding shows that more than half of the pupils possessed adequate knowledge of the concepts of blood genotype and sickle cell disease. The finding agrees with Adegbite (2021), who reported that 60.6% of respondents had good knowledge of sickle cell disease. It also aligns with Imam-Fulani *et al.* (2024), who found that 56% of respondents had good knowledge of blood genotype and sickle cell disease. Agbozo *et al.* (2023) reported that 71.2% of healthcare trainee students had good knowledge of sickle cell disease. Afolabi *et al.* (2024) found that 97.1% of respondents had good knowledge of premarital genotype screening.

However, the finding contradicts several previous studies that reported poor knowledge despite high awareness. Olakunle *et al.* (2013) found that comprehensive knowledge of sickle cell disease was low despite good awareness. Oluwadamilola *et al.* (2021) also reported poor knowledge of genotype screening and sickle cell disease. The finding also disagrees with Boadu (2018), Brown *et al.* (2022), Shuaibu (2019), Oluwole *et al.* (2018), Ngwengi *et al.* (2020), Musa (2016), and Owolabi *et al.* (2011) who all reported inadequate knowledge of sickle cell disease among students despite high levels of awareness. It also does not corroborate with the report of Adesina *et al.* (2022) who found that only 15.9% of respondents had good knowledge of sickle cell disease. The discrepancy may be attributed to differences in the measurement of knowledge, study settings and educational interventions. The introduction of health education campaigns and increased social media exposure may have contributed to improved knowledge among pupils in Lafia.

The study further showed that pupils had a moderate to positive perception of blood genotype and sickle cell disease. Respondents agreed that every pupil should know his or her genotype, genotype testing is important before marriage, schools should teach pupils about blood genotype and sickle cell disease, and individuals living with sickle cell disease should be treated with respect. This finding agrees with Faremi *et al.* (2018), who reported that students had good perceptions of premarital genotype screening and believed it could prevent the birth of children with sickle cell disease. It also aligns with Brown *et al.* (2022), who found that the majority of respondents had positive attitudes toward individuals living with sickle cell disease and supported genotype screening. It also corroborates the report of Afolabi et al. (2024) who found that most respondents had positive perceptions of premarital genotype screening. It is also in consonant with Chukwurah *et al.* (2019) who found that students demonstrated positive attitudes toward genetic sickle cell screening. Agbozo *et al.* (2023) also reported positive perceptions regarding the benefits of sickle cell testing. The finding also corresponds with Shuaibu (2019), who reported that students expressed sympathy and concern for people living with sickle cell disease. The positive perception observed in the present study may be due to increased awareness and educational exposure. It may also be attributed to the recognition of genotype testing as a preventive strategy against sickle cell disease.

Despite the generally positive perception, the study revealed the persistence of a misconception among some respondents that sickle cell disease is spiritual in origin. This finding agrees with Olakunle *et al.* (2013), who found that 25.5% of students believed that sickle cell disease was caused by evil spirits. It also corresponds with Musa (2016), where some respondents demonstrated misconceptions regarding the causes and transmission of sickle cell disease. The persistence of such misconceptions may be linked to cultural beliefs and misinformation from informal sources.

The study revealed that there was no statistically significant association between age, sex, class, religion, ethnicity, parental educational level and knowledge of blood genotype and sickle cell disease among pupils in Lafia Local Government Area ($p > 0.05$). The finding agrees with Owolabi *et al.* (2011), who reported that

although certain demographic characteristics influenced awareness, overall knowledge of sickle cell disease remained generally poor across categories of students. It also aligns with some observations from Brown *et al.* (2022), where demographic characteristics were not strong determinants of knowledge levels among participants.

However, the finding disagrees with Boadu (2018), who reported that higher level of educational and knowing a relative with sickle cell disease significantly influenced knowledge. It also contradicts Adegbite (2021), who found significant associations between gender, academic discipline and knowledge. Agbozo *et al.* (2023) reported that age and source of information were significantly associated with knowledge. The finding of this study does not align with Osonuga *et al.* (2025) who found that age, ethnicity, religion, and marital status significantly influenced awareness levels. Adesina *et al.* (2022) also reported that current level of study and marital status significantly influenced knowledge of sickle cell disease. The disagreement may be attributed to differences in study populations, age categories, sample sizes and educational backgrounds.

CONCLUSION

Awareness of blood genotype among pupils in Lafia Local Government Area was high. Majority of respondents were aware of of blood genotype and sickle cell disease. The main source of inromation was schools. More than half of the pupils knew their genotype, although some still did not know their haemoglobin status. Most respondents had good knowledge of blood genotype and sickle cell disease. Positive perceptions regarding genotype testing, sickle cell disease prevention, and respect for affected individuals were also observed. However, some misconceptions regarding the spiritual origin of sickle cell disease were still observed. No significant association was found between age, sex, class, religion, ethnicity, parental educational level and knowledge of blood genotype and sickle cell disease. The study recommends increased access to genotype testing and continuous public enlightenment campaigns to improve knowledge of personal genotype status, correct misconceptions, and contribute to the prevention and control of sickle cell disease among future generations.

REFERENCES

1. Abah, M. A., Archibong, E. U., & Oladosu, M. A. (2025). The protective role of sickle cell trait against Plasmodium falciparum malaria. *J Hum Virol Retrovirol*, *12*(1), 23-31.
2. Adamu, I. (2026). Assessment of knowledge, attitudes, and practices regarding premarital genotype counselling and testing for sickle cell disease among African international students at universities in Gujarat state, India. *International Journal of Community Medicine and Public Health*, *13*(2), 792.
3. Adegbite, O. A. (2021). Young people's knowledge of sickle cell disease and willingness for genotype screening in Ibadan, Nigeria. *African Journal of Biomedical Research*, *24*(2), 211-217.
4. Adesina, O. A., Ogamba, C. F., & Osibogun, A. (2022). Premarital genotype screening for sickle cell disease: knowledge gaps, perception and determinants of uptake among final year undergraduates of a tertiary institution in South-west Nigeria. *Nigerian Medical Journal: Journal of the Nigeria Medical Association*, *63*(1), 50.
5. Afolabi, A. S., Adekanle, D. A., Fasanu, A. O., Bola-Oyebamiji, S. B., Adetunji, E. O., Afolabi, Z. B., ... & Akinbola, A. I. (2024). RESEARCH Open Access Knowledge and Perception about Premarital Sickle Cell Genotype Screening among Undergraduates of Osun State University, Osun State.
6. Agbozo, W. K., Amanor, E., Acheampong, E. O., Kotei, B., Attoh, L. N., Yeboah, D., ... & Larbi, A. (2023). Assessing knowledge of sickle cell disease and health beliefs on premarital genetic screening among healthcare trainees at a tertiary institution: A cross-sectional study. *Health science reports*, *6*(2), e1128.
7. Agidi, P. A. (2025). Urbanization And Security Challenges in Lafia, Nasarawa State Since 1996. *Journal of Arts, Religion, Philosophy and Cultural Studies*, *1*(2).
8. Ahmed, S. K. (2024). How to choose a sampling technique and determine sample size for research: A simplified guide for researchers. *Oral Oncology Reports*, *12*, 100662.
9. Akodu, S. O., Diaku-Akinwumi, I. N., & Njokanma, O. F. (2013). Age at diagnosis of sickle cell anaemia in Lagos, Nigeria. Mediterranean journal of hematology and infectious diseases, 5(1),

e2013001.
10. Alexander, L. K., Lopes, B., Ricchetti-Masterson, K., Yeatts, K. B., & ERIC, N. (2015). Cross-sectional studies. *ERIC notebook*, *2*(6), 1-5.
11. Ameen, H. A., Abidoye, A. K., Alatishe-Muhammad, B. W., Aderibigbe, S. A., Uthman, M. M. B., Bolarinwa, O. A., ... & Akande, T. M. (2016). Prevalence of heamoglobin genotype screening and awareness of SCD among undergraduate students of Unilorin. *Journal of Medicine and Biomedical Research*, *15*(1), 14-27.
12. Awe, G. F. (2018). Exploring the role of religious leaders in preventing sickle cell disease in Nigeria (Doctoral dissertation, Walden University).
13. Bazuaye, G. N., & Olayemi, E. E. (2009). Knowledge and attitude of senior secondary school students in Benin City Nigeria to Sickle Cell Disease. *World Journal of Medical Sciences*, *4*(1), 46-49.
14. Boadu, I. (2018). AddoahT (2018) Knowledge, Beliefs and Attitude towards Sickle Cell Disease among University Students. *J Community Med Health Educ*, *8*(593), 2161-0711.
15. Brown, J. N., Atulley, E., Tamag, T., Ababio, E. R., & Prah, J. K. (2022). Assessing the knowledge, attitude and perception towards sickle cell disease among university students in Ghana. *European Journal of Health Sciences*, *7*(1), 1-12.
16. Chukwurah, E., Oduma, F., Madubuattah, C., & Chukwurah, F. (2019). Assessment of knowledge and attitude of sickle cell genetic screening among fresh undergraduate students of Ebonyi state university. *Abakaliki, Nigeria*. *Journal of Medical Laboratory Science*, 29(3), 8-20.
17. Cochran, W. G. (1977). *Sampling techniques*. john wiley & sons.
18. Cvetkovic-Vega, A., Maguiña, J. L., Soto, A., Lama-Valdivia, J., & Correa López, L. E. (2021). Cross-sectional studies. *Revista de la Facultad de Medicina Humana*, *21*(1), 164-170.
19. Ezenwosu, O. U., Chukwu, B. F., Ezenwosu, I. L., Ikefuna, A. N., Emodi, I. J., & Ezeanolue, E. E. (2021). Knowledge and awareness of individual sickle cell genotype among adolescents in a unity school in Southeast, Nigeria: a cross-sectional study. *International Journal of Adolescent Medicine and Health*, *33*(6), 395-400.
20. Ezenwosu, O. U., Chukwu, B. F., Ikefuna, A. N., Hunt, A. T., Keane, J., Emodi, I. J., & Ezeanolue, E. E. (2015). Knowledge and awareness of personal sickle cell genotype among parents of children with sickle cell disease in southeast Nigeria. *Journal of community genetics*, *6*(4), 369-374.
21. Faremi, A. F., Olatubi, I. M., & Lawal, Y. R. (2018). Knowledge of sickle cell disease and premarital genotype screening among students of a tertiary educational institution in South Western Nigeria. *International Journal of Caring Sciences*, *11*(1), 285-295.
22. Imam-Fulani, A. (2024). Knowledge, Attitude and Perception of Sickle Cell Disease, on Premarital Genotype Screening, Among Undergraduate of Al-Hikmah University Ilorin. Nigeria.
23. Inusa, B. P., Daniel, Y., Lawson, J. O., Dada, J., & Matthews, C. E. (2015). Sickle Cell Disease Screening in Northern Nigeria: The Co-Existence of B-Thalassemia Inheritance. *Pediat Therapeut* 5: 262.
24. Kavanagh, P. L., Fasipe, T. A., & Wun, T. (2022). Sickle cell disease: a review. *Jama*, *328*(1), 57-68.
25. Kesmodel, U. S. (2018). Cross-sectional studies–what are they good for?. *Acta obstetricia et gynecologica Scandinavica*, *97*(4), 388-393.
26. Kiyaga, C. (2024). *The Epidemiology of Childhood Sickle Cell Anaemia and the Disease Modifying Effects of the-α3. 7Deletional form Of α-Thalassaemia and the Glucose-6-phosphate Dehydrogenase G202t Allele in Uganda* (Doctoral dissertation, Open University (United Kingdom)).
27. Knapp, T. R., & Mueller, R. O. (2010). Reliability and validity of instruments. *The reviewer's guide to quantitative methods in the social sciences*, 337-342.
28. Maboulou, V., Ngoutane, A., Molu, J., Mansour, M., Kountchou, C., Djoulde, I., ... & Essome, M. C. N. (2022). Sickle cell trait, knowledge, attitudes, practices and perceptions regarding sickle cell disease among people living in Yaoundé. *Int Res J Med Med Sci*, *10*(3), 44-52.
29. Magaji, S., Oyinloye, A. A., Musa, I., & Ismail, Y. (2025). Evaluating the housing and living conditions of migrants in Lafia, Nasarawa State, Nigeria. *International Journal of Research and Innovation in Social Science (IJRISS), 9 (7)*, 6357-6368.
30. Makani, J., Ofori-Acquah, S. F., Nnodu, O., Wonkam, A., & Ohene-Frempong, K. (2013). Sickle cell disease: new opportunities and challenges in Africa. The scientific world journal, 2013(1), 193252.
31. Mazhar, S. A., Anjum, R., Anwar, A. I., & Khan, A. A. (2021). Methods of data collection: A

fundamental tool of research. *Journal of Integrated Community Health (ISSN 2319-9113)*, *10*(1), 6-10.
32. Mazhar, S., Stilwell, L., Waqar Farooqi, Z., & Singletary, N. (2025). Breastfeeding measurement-choosing a scale to measure breastfeeding attitudes and beliefs. *Journal of Human Lactation*, *41*(3), 318-331.
33. Muhammed, A., & Ojo, M. (2026). Relationship Between Knowledge Attitude and Practice of Premarital Genetic Counseling And Testing For Sickle Cell Disease Among Undergraduate Students. *Research Journal of Health, Medicine and Nursing*, *14*(2), 1-10.
34. Musa, Y. (2016). Knowledge and attitude regarding premarital screening for sickle cell disease among students of State school of nursing Sokoto. *Annals of International Medical and Dental Research*.
35. Ngwengi, N. Y., Fon, P. N., & Mbanya, D. (2020). Distribution of haemoglobin genotypes, knowledge, attitude and practices towards sickle cell disease among unmarried youths in the Buea Health District, Cameroon. *The Pan African Medical Journal*, *37*, 109.
36. Obadiah, B., & Daniel, B. (2013). Identification of Slum Areas for Improvement Inputs in Lafia Town, Nasarawa State. *International Journal of Humanities and Social Sciences*, 7(3), 794-800.
37. Obadiah, M. B., & Haruna, B. B. (2025). Examination of the typology of public open spaces in Lafia Town, Nasarawa State, Nigeria.
38. Olakunle, O. S., Kenneth, E., Olakekan, A. W., & Adenike, O. B. (2013). Knowledge and attitude of secondary school students in Jos, Nigeria on sickle cell disease. *Pan African Medical Journal*, *15*(1).
39. Oluwadamilola, A. D., Akinreni, T. I., Adefisan, M. A., & Olayiwola, S. D. (2021). Knowledge, attitude and control practices of sickle cell diseases among senior secondary students in Osun State, Nigeria. *The Pan African Medical Journal*, *38*, 350.
40. Oluwole, E. O., Bakare, O. Q., Akinbami, A., & Ayokunle, I. T. (2018). Knowledge and Attitude of Public Secondary School students towards Sickle Cell Disease in Lagos, Nigeria. *Nigerian Quarterly Journal of Hospital Medicine*, *28*(3).
41. Osonuga, A. A., Osonuga, A., Ahamefula, C., Okoye, G., Osonuga, O. A., DaCosta, A., ... & DaCosta, D. (2025). Exploring the Role of Premarital Genetic Counselling and Sickle Cell Disease Prevention: A Study of Awareness and Knowledge among Nigerian Female Undergraduates. *Medical Journal of Dr. DY Patil Vidyapeeth*, *18*(Suppl 2), S269-S276.
42. Owolabi, R. S., Alabi, P., Daniel, O., Ajayi, S., Otu, T., & Ogundiran, A. (2011). Knowledge and attitudes of secondary school students in Federal Capital Territory (FCT), Abuja, Nigeria towards sickle cell disease. *Nigerian Journal of Medicine*, *20*(4), 479-485.
43. Piel, F. B., Hay, S. I., Gupta, S., Weatherall, D. J., & Williams, T. N. (2013). Global burden of sickle cell anaemia in children under five, 2010–2050: modelling based on demographics, excess mortality, and interventions. PLoS medicine, 10(7), e1001484.
44. Shuaibu, M. S. (2019). Knowledge, beliefs, and attitude of students at Kampala International University towards sickle cell disease.
45. Tebbi, C. K. (2022). Sickle cell disease, a review. *Hemato*, *3*(2), 341-366.
46. Uche, E., Olowoselu, O., Augustine, B., Ismail, A., Akinbami, A., Dosunmu, A., & Balogun, A. (2017). An assessment of knowledge, awareness, and attitude of undergraduates toward sickle cell disease in Lagos, Nigeria. *Nigerian Medical Journal*, *58*(6), 167-172.
47. Wang, X., & Cheng, Z. (2020). Cross-sectional studies: strengths, weaknesses, and recommendations. *Chest*, *158*(1), S65-S71.
48. Whicker, F. W., Bunzl, K., Dixon, P., Scott, E. M., Sheppard, S. C., & Voigt, G. (2006). 4 Estimating Statistical Quantities: Mean, Total, Proportion, Percentile, and Ratio. *Journal of the ICRU*, *6*(1), 35-48.
49. World Health Organization (WHO), (2018). Updated Estimates of the Frequency of the Haemoglobin Disorders in Each Country.
50. World Health Organization. (2025). Sickle cell disease. Geneva: World Health Organization. Available onlin at: https://www.who.int/news-room/fact-sheets/detail/sickle-cell-disease
51. Yang, J., Ren, Z., Wang, J., & Li, L. (2022). Determining the Sampling Size with Maintaining the Probability Distribution. In *National Conference of Theoretical Computer Science* (pp. 61-74). Singapore: Springer Nature Singapore.