

Assessment of Experience, Perception and Attitude Towards Premarital Sickle Cell Disease Screening Among Students Attending Federal College of Education, Kano, Nigeria

ABSTRACT

Background: Sickle cell disease is a condition in which an individual inherits two abnormal haemoglobin genes from both parents β^s/β^s (HbSS) resulting in a pathological state which is attributed to the sickling phenomenon, vaso-occlusion crises, infection and other complications. About 5% of the world's population carries genes responsible for haemoglobinopathies and each year about 300 000 infants are born with major haemoglobin disorders including more than 200 000 cases of sickle-cell disease in Africa. Sickle cell disease is a very common disorder in Nigeria with a birth rate of about 1 in 50 and about 150,000 children are born annually with sickle cell anaemia in Nigeria alone. The study aimed to **assess** the knowledge and attitude of students attending the Federal College of Education, Kano about premarital screening for sickle cell disease.

Methods: A descriptive, cross-sectional study was conducted using interviewer-administered structured questionnaire among 305 students. Descriptive statistics of frequency count and percentages were used to describe the demographic data, while the non-parametric statistics of chi-square set at $P = 0.05$ level of significance were used to test the hypotheses that there is no significant difference in the attitude towards premarital sickle cell screening between students of different demographic backgrounds studying different programmes at Federal College of Education, Kano.

Results: Forty-six percent of respondents had low knowledge of sickle cell disease, and 40 percent had negative attitude towards premarital sickle cell screening. The predictors of knowledge are program of study in which students are enrolled, religion and age (each $P = 0.00$), while those predictors for attitude towards premarital sickle cell screening include religion, knowledge of sickle cell disease and marital status, each at $P = 0.00$ at 95% level of significance.

Conclusion: The students have poor knowledge and attitude towards sickle cell disease and premarital screening. The importance of health education as a keystone is necessary in improving knowledge and attitude towards premarital screening for sickle cell disease.

Keywords: Attitude, Perception, Premarital, Screening, Sickle Cell Disease

1. INTRODUCTION

Pre-marital genetic screening health service targeted at individuals and families which try to enable people with a genetic disadvantage, and their families to live and reproduce as normally as possible. Genetic screening often assures access to relevant medical services (diagnostic, therapeutic, counseling, rehabilitative and preventive) and social support systems, and it helps people at risk to adapt to their unique situation by providing information to enable educated and voluntary choices in health and reproductive matters [1]. Pre-marital genetic screening can identify and modify behavioural, medical and other health risk factors known to impact pregnancy outcomes through prevention and management. It is capable of reducing the burden that birth defects and genetic disorders impose on most couples and people [2].

One of the biggest health challenges to the human race is sickle cell disorder [1]. It is a genetic disorder transmitted from parents to their offspring's. The disorder is associated with many challenges resulting from frequent hospitalization of the affected individual due to vaso-occlusion crises or other forms of complications. Despite major advances in our understanding of the molecular pathology, pathophysiology, and causes of the inheritable disorders, thousands of infants and children are dying through lack of appropriate preventive measures such as lack of premarital sickle cell screening by intending couples to know their haemoglobin genotype before marriage [3].

Some of the objectives of pre-marital genetic screening includes: early recognition of disorder for intervention that prevents or reverses the disease process; or to ensure optimal management of the patient, that is, appropriate referrals to specialists when symptoms are anticipated and, informed reproductive decisions or disease management [4]. It has been recommended that it is time to start ascertaining the compatibility of intending couples to make marriages work better, and on more realistic grounds by way of premarital screening and testing [1]. There is need to encourage the practice of premarital sickle cell screening. Prevention of sickle cell disorder and risk minimization through screening and carrier identification remains the only realistic approach to reduce the impact of the disease especially in an adult population. Tertiary institutions have large concentration of adult population and they form important sub groups of the population since they are at a relatively high level of education and in the manageable age group [5], thus the aim and target of the study.

Healthy manpower is vital to national development. Nigeria is a developing country yearning for development. The health and wellbeing of students from tertiary institutions as potential manpower of the nation should be of great concern. Therefore, this study was designed to find out the knowledge and attitude of students of Federal College Education, Kano, towards pre-marital genetic screening.

2. MATERIAL AND METHODS

2.1 Respondents recruitment and Sample collection

The instrument used for data collection was a self-administered structured questionnaire, which was validated by pre-test and post-test validations. The

reliability of the questionnaire was ensured by administration of the same questionnaire to the same set of respondents at two different time spaces (before and after the survey). The responses obtained were correlated. The questionnaire was validated at correlation coefficient ($r \geq 0.70$). All questions were drawn strictly based on the stated objectives and literatures reviewed on premarital sickle cell screening. Both male and female students of various age groups who are either married or single, who were readily present at the time of the study and voluntarily gave their consent to participate in the study were recruited. Non-students at Federal College Education, Kano were excluded from the study. Following reception of students' consent (Appendix I) and ethical clearance (Appendix II) from appropriate authorities, a total number of 305 venous blood samples were aseptically collected in anticoagulated sodium heparin universal container from both sexes of students of various age groups offering different programmes such as preliminary National Certificate of Education (Pre-NCE), National Certificate of Education (NCE), Bachelor of Education (B. Ed) and Postgraduate Diploma in Education (PGDE) at Federal College Education, Kano. A sample size of 305 adult students (married and single) was used. Sample size was determined based on the prevalence reported from initial study [6] carried out around the country using equation:

$$n = \frac{Z^2 pq}{d^2}$$

Where;

n = Minimum number of samples required (sample size)

Z = Standard normal deviate at 95% confidence interval = 1.96

p = Prevalence from initial studies = 72.7% = 0.727 Omuemu *et al.*, [6].

d = degree of confidence at = 0.05

q = 1-p = 1 - 0.727 = 0.273

$$n = \frac{1.96^2 \times 0.727 \times 0.273}{0.05^2} = \frac{3.8416 \times 0.19871}{0.0025} = 304.97 \approx 305$$

Therefore, minimum sample size for the study is 305.

The corresponding blood samples were transported and analyzed at Hematology laboratory, Aminu Kano Teaching Hospital (AKTH), Kano, Nigeria for haemoglobin genes genotyping using the methods of Bello *et al* [7]. The anticoagulant blood was centrifuged at 2500rpm. The supernatant plasma was discarded, and packed cells were washed with saline. Finally, the red cells were hemolyzed by adding equal volume of distilled water. A volume of 2ml toluene and one drop of 3% potassium cyanide were mixed together. The buffer was poured into the electrophoresis chamber, with two electrodes soaked in the buffer. The cellulose acetate paper was re-soaked in the buffer and left to soak for 20minutes. Excess buffer was removed by keeping the plate between absorbent papers.

96 A volume of 0.5ml of the haemolysate samples test and control were applied
97 approximately 3cm away from the cathode using applicator stick. The cellulose
98 acetate membrane plate was placed in the electrophoretic chamber, which was
99 connected to the power supply. The electrophoresis was allowed to run for 20
100 minutes at approximately 35°C. The power supply was disconnected, and the result
101 was read [8].

102 2.2 Method of data analysis

103 The quantitative raw data were collated and tallied. Descriptive statistics including
104 frequencies, percentages, were used to present the data. Chi-square was used to
105 test the hypotheses at 95% confidence interval 0.05 levels of significant. All the
106 statistical analyses were performed using statistical package for social sciences
107 (SPSS), version 18.

108 A four-point rating scale Likert scale that ranged from strongly agree= 1, Agree= 2,
109 disagree= 3, to strongly disagree= 4, was used to measure attitude. The positive
110 items were rated 4 and 3. Whereas all the negatively worded items were reverse
111 scored, in that score of 4 is rated 1, and 3 is rated 2 etc. Individual mean score was
112 used to find the total mean score for the entire student. A Positive attitude is
113 indicated by a mean score above 2 and this showed that the participants agree and
114 strongly agree to the correct answers, while mean scores of 2 and below shows that
115 the respondents disagree and strongly disagree to the correct answers.

116 A knowledge scoring system was developed for the knowledge items of the
117 questionnaire. "Do not know" answers were treated as incorrect and given a score
118 of "0", whereas each correct answer was given a score of "1". The total knowledge
119 score was calculated and ranged from 0 to 27. The knowledge score was classified
120 as low knowledge, <13.5 and high knowledge >13.5 score. Knowledge was
121 assessed using the mean score of 13.5 from items in items of knowledge of the
122 questionnaire. Scores above 13.5 were considered high level of knowledge while
123 scores of 13.5 and below were regarded as low level of knowledge.

124 3. RESULTS

125
126
127 A total of 305 students (41% male) responded. Age distribution of the respondents
128 is shown in Table 1. The highest response was in the age group 21-25 (32.5%), and
129 the lowest, 46 years and older (4.9%). Sixty-nine percent were Muslims (Islamic
130 Religion), and 31% Christians (Table1).

131 Less than half of the total 124 respondents (40.7%) were assessed with positive
132 attitudes towards premarital sickle cell screening through graded scale
133 questionnaire, while the rest showed negative attitude towards premarital sickle cell
134 screening.

135 Table 2 shows the relationship between attitude and knowledge level of premarital
136 sickle cell screening and gender of respondents. More female students had greater
137 knowledge and more positive attitude than male students.

138 **Table 1. Demographic Characteristics of the students (n=305) attending the**
 139 **institute**

	Demographic Variables	Frequency	Percentage (%)
Gender	Male	125	41.0
	Female	180	59.0
Age	16 – 20	70	23.0
	21 – 25	100	32.8
	26 – 34	50	16.4
	35 – 40	45	14.8
	41 – 45	25	8.2
	46 and Above	15	4.9
Marital Status	Single	100	32.8
	Married	150	49.2
	Divorced	25	8.2
	Widowed	30	9.8
Religion	Islam	210	68.9
	Christianity	95	31.1
Programme of Studies	Pre-NCE	70	23.0
	NCE	95	31.1
	B. Ed	90	29.5
	PGDE	50	16.4
Knowledge Assessment	High Level Knowledge	140	45.9
	Low Level Knowledge	165	54.1
Attitude	Positive Attitude	124	40.7
	Negative Attitude	181	59.3

140 Pre-NCE= Preliminary National Certificate of Education; NCE= National Certificate
 141 of Education; B. Ed= Bachelor of Education; PGDE= Postgraduate Diploma in
 142 Education

143

144 **Table 2. Attitude and Knowledge Level of Premarital Sickle Cell Screening and**
 145 **Gender of Students**

Gender	Knowledge Assessment		Total
	High Level	Low Level	
Male	53	72	125
Female	87	93	180
Total	140	165	305
Gender	Attitude Assessment		Total
	Positive Attitude	Negative Attitude	
Male	49	76	125
Female	75	105	180
Total	124	181	305

146

147 **Table 3. Attitude and Knowledge Level of Premarital Sickle Cell Screening and**
 148 **Marital Status of Students**

Marital Status	Knowledge Assessment		Total
	High Level	Low Level	
Single	41	59	100
Married	80	70	150
Divorced	9	16	25
Widowed	10	20	30
Total	140	165	305
Marital Status	Attitude Assessment		Total
	Positive Attitude	Negative Attitude	
Single	27	73	100
Married	74	76	150
Divorced	13	12	25
Widowed	10	20	30
Total	124	181	305

149

150 Married and single students show high level of knowledge 53.3% and 41.0%
 151 respectively as regard to divorced and widowed marital status group with
 152 prevalence of 36.0% and 33.3%. Attitude of the respondents is in disparity with
 153 knowledge assessment as Divorced marital status group showed highest positive
 154 attitude 52.0% followed by the married and widowed individuals 49.3% and 33.3%
 155 respectively, the least being singles 27.0% (Table 3).

156 A prevalence of 45.9% was observed for high knowledge about premarital sickle cell
 157 screening, respondents in the study based on age, showed that age group 35 – 40
 158 were observed to have the highest prevalence of 66.7%, followed by 41 – 45 and 21
 159 – 25 age groups having 60.0% and 49.0% prevalence respectively. The lowest
 160 prevalence 31.4% was observed in the age group 16 – 20, age groups of 26 – 34
 161 and 46 and above had a prevalence of 38.0% and 33.3% respectively (Table 4).
 162 Table 4 shows the attitude of the respondents towards premarital sickle cell
 163 screening with reference to age. Age groups 46 and Above and 35 – 40 shows high
 164 attitude of the respondents 66.7% and 53.3% respectively compared to age groups
 165 16 – 20 and 21 – 25 with lowest attitudes 31.4% and 39.0% respectively.

166 **Table 4. Attitude and Knowledge Level of Premarital Sickle Cell Screening and**
 167 **Age of Students**

Age	Knowledge Assessment		Total
	High Level Knowledge	Low Knowledge	
16 – 20	22	48	70
21 – 25	49	51	100
26 – 34	19	31	50
35 – 40	30	15	45

41 – 45	15	10	25
46 and Above	5	10	15
Total	140	165	305
Attitude Assessment			
Age	Positive Attitude	Negative Attitude	Total
16 – 20	22	48	70
21 – 25	39	61	100
26 – 34	19	31	50
35 – 40	24	21	45
41 – 45	10	15	25
46 and Above	10	5	15
Total	124	181	305

168

169 The results of table 5 shows that Pre-NCE students has the least knowledge about
170 the topic followed by NCE students 35.8% while PGDE and B. Ed students shows
171 higher prevalence about knowledge of premarital sickle cell screening 70.0% and
172 50.0% respectively. The attitude of the respondents shows that PGDE students are
173 the only group with positive attitude 50.0% towards premarital sickle cell screening
174 while all the other group of students in other programme of studies have negative
175 attitude toward premarital sickle cell screening as follows NCE (45.3%), Pre-NCE
176 (30.0%), and B. Ed (38.9%) with statistical significance ($P = 0.109$). Therefore, there
177 is no significant difference in positive attitude towards premarital sickle cell
178 screening between students of different programmes at Federal College of
179 Education, Kano (Table 5).

180

181 **Table 5. Relationship between Attitude and Knowledge Level of Premarital**
182 **Sickle Cell Screening and Programme of Studies of Respondents**

Programme of studies	Knowledge Assessment		Total	χ^2
	High Level	Low Level		
	26	44	70	
NCE	34	61	95	
B. Ed	45	45	90	
PGDE	35	15	50	0.109
Total	140	165	305	
Programme of studies	Attitude Assessment		Total	
	Positive Attitude	Negative Attitude		
Pre-NCE	21	49	70	
NCE	43	52	95	
B. Ed	35	55	90	
PGDE	25	25	50	

Total	124	181	305
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$P \leq .05$ is statistically significant, Pre-NCE= Preliminary National Certificate of Education; NCE= National Certificate of Education; B. Ed= Bachelor of Education; PGDE= Postgraduate Diploma in Education

Knowledge assessment of premarital sickle cell screening shows that most of the respondents that are Muslims (Islamic Religion) have low knowledge (31.4%) while majority (77.9%) of the Christians (Christianity religion) have high knowledge (Table 6). Respondents with Christianity religion shows majority 68.4% of them with positive attitude towards Premarital Sickle Cell screening and the respondents with Islamic religion have negative attitude 28.1% towards premarital sickle cell screening having statistical significance of $P = 0.00$, which indicates the rejection of the null hypothesis (H_2) and accepting the alternate, therefore there is significant difference in the attitude towards premarital sickle cell screening due to religion among students of Federal College of Education, Kano (Table 6).

Table 6. Relationship between Attitude and Knowledge Level of Premarital Sickle Cell Screening and Religion of Respondents

Religion	Knowledge Assessment			χ^2
	High Level	Low Level	Total	
Islam	66	144	210	0.00
Christianity	74	21	95	
Total	140	165	305	
Religion	Attitude			
	Positive Attitude	Negative Attitude	Total	
Islam	59	151	210	0.00
Christianity	65	30	95	
Total	124	181	305	

$P \leq .05$ is statistically significant

The relationship between knowledge of premarital sickle cell screening and attitude shows that majority 60.0% of the students who have high knowledge on premarital sickle cell screening also shows positive attitude towards it, likewise majority 75.8% of the students with negative attitude are seen to have low knowledge on the subject matter, giving a statistical significance of $P = 0.00$, indicating the rejection of the null hypothesis. Therefore, there is a statistically significant positive correlation between high level knowledge and positive attitude. Conversely, there is a significant correlation between low level knowledge and negative attitude (Table 7).

Table 7. Relationship between knowledge of premarital sickle cell screening and Attitude towards premarital sickle cell screening

212

Knowledge Assessment		Attitude			χ^2
		Positive Attitude	Negative Attitude	Total	
High Knowledge	Level	84	56	140	0.00
Low Knowledge	Level	40	125	165	
Total		124	181	305	

213 $P \leq .05$ is statistically significant

214

215 4. DISCUSSION

216 This study was conducted with the aim of assessing the knowledge and attitude of
 217 the student of Federal College of Education, Kano regarding premarital screening
 218 for sickle cell disease. Total number of respondents are 305 for the study of which
 219 majority are females and Muslims. The respondents cut across various socio-
 220 demographic characteristics with their age ranging from 16-46 and above years.
 221 Majority of the respondents are between 21years and 25years. The fact that a
 222 reasonable number of the respondents are single makes the study most appropriate
 223 for the study group because the respondents need to be aware of the importance of
 224 premarital sickle cell screening before they get married (Table 1).

225

226 Majority of the respondents have low knowledge about sickle cell anaemia and is
 227 consistent with the position of Isah [9] where about 65.7% of the population have
 228 poor knowledge about premarital sickle cell screening in Sokoto, Nigeria among
 229 school of nursing students and inconsistent with that of Arulogun [10]. Most of the
 230 respondents who have heard of genetic disease knew the cause. However, a
 231 reasonable proportion demonstrated a poor knowledge about the cause of genetic
 232 diseases. This indicates the need for enlightenment about the causes of genetic
 233 diseases. Exactly, 45.9% of the students had higher knowledge of level 3 or 4,
 234 whereas, 54.1% had poor knowledge of level 1 or 2. Similarly, lower level of
 235 awareness of genotype was reported from studies among youths in selected areas
 236 in Lagos, Nigeria [3], which contrasted with findings reported from studies among
 237 undergraduate students in Yobe State, Nigeria [11].

238 The result of this study showed that there is significant difference in the knowledge
 239 of premarital sickle cell screening due to gender among students of Federal College
 240 of Education, Kano. This is reflected in Table 2 of the study showing higher
 241 percentage of female students having more knowledge and attitude greater than
 242 that of the male students. This result is in contrast with the findings of Schmidt [12]
 243 which showed that males scored higher on knowledge and were more susceptible to
 244 fear of diseases than their female counterparts. Conversely in line with, Al-Aama et

245 *al.* [13] reported in a study on knowledge regarding the national premarital screening
246 program among university students in Western Saudi Arabia, they found out that
247 females have more knowledge than males. Sobhy *et al.* [4] submit that there is a
248 positive correlation between knowledge and attitude, hence, this study and similar
249 studies like that of Abd-Al-Azeem *et al.* [5] demonstrated that females were more
250 oriented and more knowledgeable with important health issues related to pre-marital
251 genetic screening than males which they said later reflected on their better attitude.
252 Al-Aama [13] in a study on attitudes towards mandatory national premarital
253 screening for hereditary hemolytic disorders discovers that women also had better
254 knowledge and stronger attitudes toward the implementation of screening with a
255 significantly higher number of female respondents believing that the pre-marital
256 screening should be mandatory, and that marriage should not be allowed between
257 two carriers of the same disorder.

258 More than 50% of the Postgraduate Diploma in Education (PGDE) and Bachelor of
259 Education (B. Ed) students had good knowledge of sickle cell disease, and the
260 premarital screening for the disease with a significance $P = 0.109$ due to their
261 programmes of study (Table 5). This is comparable to the 78.9% recorded among
262 undergraduate students in Benin, south-south Nigeria as stated by Omuemu *et al.*
263 [6] and the 80% recorded among youths in Yaba, a suburb of Lagos, Nigeria by
264 Oludare [14]. It is however higher than the levels recorded in various communities in
265 the Middle East [15]. The high level of knowledge of these groups of the students in
266 our study can be attributed to their high educational status. It can also be attributed
267 to the higher prevalence of sickle cell disease in Nigeria, and the fact that the
268 students are older, married and were already exposed to premarital screening, in
269 course of their getting married.

270 According to Al-Aama *et al.* [13] and Abioye *et al.* [3], the effectiveness of carrier
271 screening programmes depends largely on the awareness of the target population.
272 This is consistent with the current study because the analysis of the relationship
273 between knowledge and attitude of pre-marital genotype screening, which shows
274 that knowledge is a strong determinant of attitude of premarital genotype screening
275 $P < 0.05$ (at 95% significant level). This implies that the respondents ought to be
276 aware of the importance of genotype screening for them to be screened (Table 7).
277 However, since this is a small specialized subset of students, engaged in studying
278 education at the study area, then the results obtained in this study may not be
279 applicable to the general population. The findings in this study showed awareness,
280 interest and willingness of the students, especially singles, to know their genotype
281 status before marriage in order to avoid sickle cell anaemia in their future children.
282 Despite the limitations experienced during data collection, in which some students
283 refused to participate in the study due to injection phobia during sample collection,
284 and their inability to distinguish between genotype screening and stigma-oriented
285 HIV screening; the findings are outstandingly encouraging.

5. CONCLUSION

The students have poor knowledge of sickle cell disease and premarital screening, though a moderate number of the students have good attitude towards premarital screening. This is probably due to lack of knowledge of premarital sickle cell screening before getting married, insufficient standard facilities for haemoglobin genes genotyping in primary healthcare institutions, and lack of knowledge of the consequences of not doing premarital sickle cell screening. The need for health education is necessary as a keystone in improving knowledge and attitude towards premarital screening for sickle cell disease.

5.1 Recommendations

Health education about sickle cell disease shall be intensified in the schools and also shall be made available for the community. The premarital screening services should be made available for student and people in the community and shall be made affordable. Also, media shall be used as a way creating community awareness since only very few of the respondents knew sickle cell disease. Government and religious leaders should educate youths on the importance of premarital genotype screening and institute strict policies as criterion before marriages are conducted. More haemoglobin electrophoresis screening facilities should be provided at primary healthcare centers for easy accessibility.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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- 373

APPENDIX I



FEDERAL COLLEGE OF EDUCATION, KANO

CERTIFICATE OF CONSENT

PATIENT/PATIENT'S PARENT OR GUARDIAN

I have been asked to give consent for myself to participate in this research study which will involve collection of blood sample in the completion of the research study. I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily for myself to participate as a participant in this study.

Parent's age _____ Sex _____

Signature of Patient _____

Date _____

STATEMENT BY THE WITNESS

I have witnessed the accurate reading of the consent form to the parent of the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Name of witness _____

AND

Thumb print of participant

Signature of witness _____

Date _____

**STATEMENT BY THE RESEARCHER/PERSON TAKING CONSENT**

I have accurately read out the information sheet to the parent of the potential participant, and to the best of my ability made sure that the person understands that the following will be done:

1. Samples (blood samples) will be collected by an experienced examiner.
2. The samples will be analyzed in the laboratory for screening sickle cell disease.
3. The findings may be documented for public enlightenment and medical intervention by the concerned authorities.

My names are HUSSAINI M. A. (2015/PGDEE/5110), Division of Microbiology, Department Science Laboratory Technology, Zaria, Kaduna state, Nigeria. I am currently carrying out a research titled Knowledge and Attitude towards Premarital Sickle Cell Disease Screening among Students Attending Federal College of Education, Kano, Nigeria. I confirm that sufficient information, including about risk and benefits, to make an informed decision have been fully explained to the participant. I confirm that the patient/parent/patient's guardian was given an opportunity to ask questions about the study, and all the questions asked by him/her have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

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APPENDIX II



FEDERAL COLLEGE OF EDUCATION, KANO

Directorate of Continuing Education
Federal College of Education,
Kano.
21st June, 2017

Hussaini M.A.
Federal College of Education,
Kano.

Ethical approval

Sequel to the submission of the research proposal to the Advisory Committee on research of Department of Continuing Education, Research and Development on a research study titled: **Knowledge, Perception and Attitude Towards Premarital Sickle Cell Screening Among Students Attending Federal College of Education, Kano, Nigeria**. The committee after a long considerations and consultations has satisfied with the research.

The ethical committee thereby grants ethical approval for the study.

Dr. Adamu D.

Director Research

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