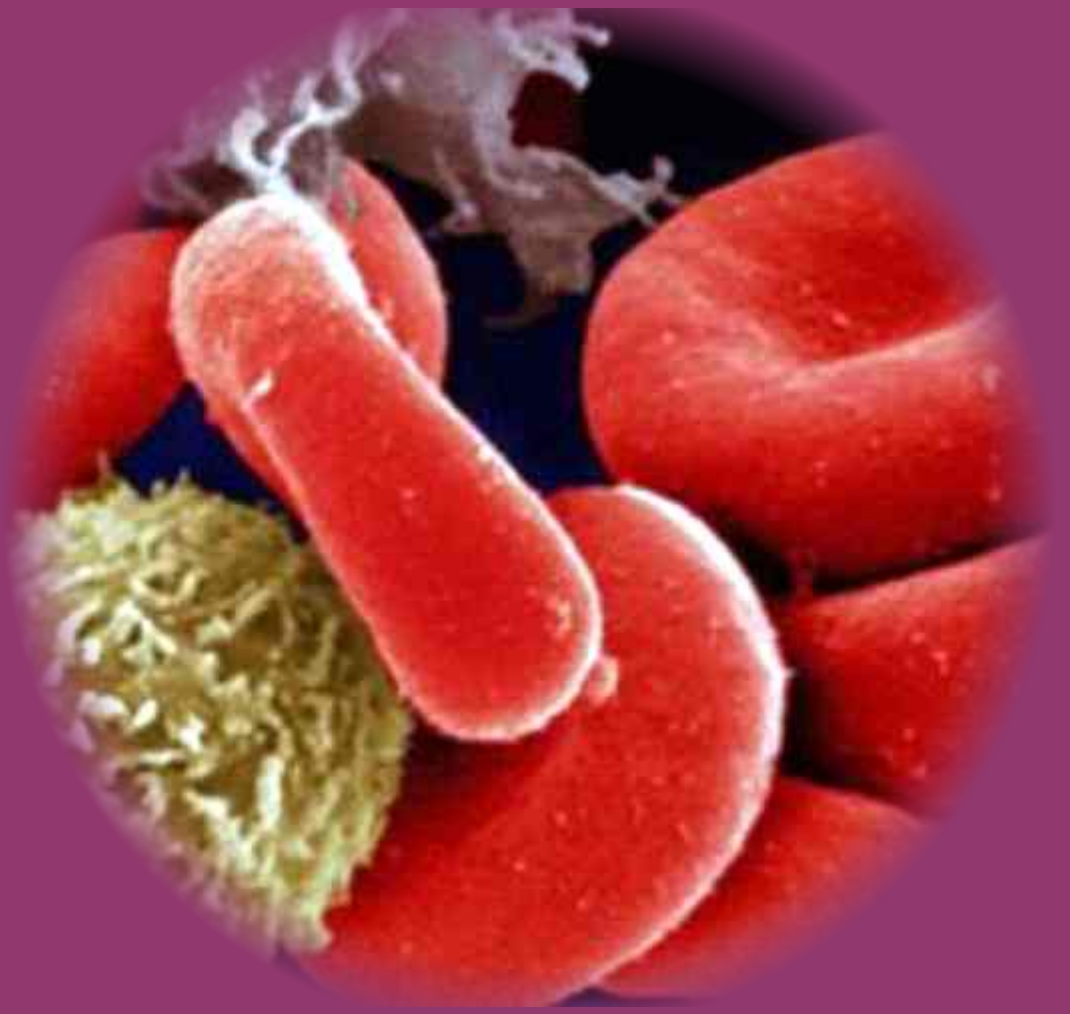
N S H B T

NIGERIAN J OURNAL OF HAEMATOLOGY

Journal of the Nigerian Society for Haematology & Blood Transfusion



ISSN: XXX - XX - XXX

VOL. 1 NO 1, AUGUST, 2017

Awareness, Knowledge and Attitude of Fresh Clinical Medical Students of the University of Jos to Sickle Cell Disease

[1]Damulak OD, [2]Pam VC, [1]Jatau ED, [3]Lekshak B, [3]Singnap Z, [1]Iheanacho C, [1]Egesie OJ

[1]Department of Haematology and Blood Transfusion, Jos University Teaching Hospital (JUTH), Jos

[2]Department of Obstetrics and Gynaecology, Jos University Teaching Hospital (JUTH), Jos

[3]Department of Haematology and Blood Transfusion, University of Jos, Nigeria

Corresponding Author:

Dr. Damulak OD

Department of Haematology and Blood Transfusion, Jos University Teaching Hospital (JUTH), Jos

E-mail: ddamulak@yahoo.com

ABSTRACT

Background:

Reports of awareness, knowledge and attitude of health care providers in training are few particularly in our setting.

Aims and Objectives:

This study sets out to assess the awareness, knowledge and attitude of fresh clinical students to sickle cell disease (SCD) and provide the basis for a training protocol.

Method:

The subjects were recruited consecutively after informed consent was obtained. A structured questionnaire was administered to participants. Three millilitres of venous blood was collected into an EDTA sample bottle to conduct haemoglobin electrophoresis.

Results:

One hundred and seventeen, aged 19-34 years, fresh clinical students of the College; eighty (70.1%) males and 37 (29.9%) females were studied. One hundred and six (90.6%) knew that SCD affects Africans more while 54.9% indicated that persons with SCD could be in the steady state. While 47.0% of the respondents knew that the disease could manifest for the first time in children aged 3-6 months, 50.4% knew that diagnosis SCD could be made in the antenatal period. 74.4% knew that the cure to SCD may be through haematopoietic stem cell transplant. Eighty eight (75.2%) are favourably disposed to disclosing their haemoglobin type. Sixty four (54.7%) subjects had earlier tested for their haemoglobin type. Haemoglobin electrophoresis was conducted for ten (15.6%) and 17 (32.1%) subjects who "knew" and "never knew" their Hb type respectively. Three known Hb phenotypes did not correspond with determined. The determined Hb types of the subjects who, "never knew", were; AA (47.1%) and AS (52.9%).

Conclusion:

High level of knowledge, awareness and subjective positive dispositions to sickle cell disease may not necessarily be demonstrated.

Keywords: clinical students, awareness, knowledge, attitude, sickle cell disease.

INTRODUCTION

Sickle cell disease is the inheritance of two abnormal haemoglobin (Hb) genes, which may be homozygous (Hb SS) or compound heterozygous where another abnormal Hb gene is inherited with Hb S gene (e.g. SC). [1] Where the inheritance is Hb SS, the disease is specifically referred to as sickle cell anaemia (SCA). The inheritance of Hb S gene along with regular adult Hb A gene (Hb AS), is termed sickle cell trait. [2] Sickle cell anaemia is the severest form of the sickle cell diseases with varying acute and chronic complications. [2,3]

Haemoglobin S gene is found in 20-30% of populations of Nigeria, Gabon, Ghana, Cameroon and the Republic of Congo, but only in 1-2% of people in North America. The lowest prevalence of less than one percent is documented in Southern Africa, while the highest prevalence of up to 45% is found in Uganda. [4] The persistence of Hb S gene is associated with malaria endemicity as the heterozygous state, Hb AS, is protective against lethal effects of malaria, while the homozygous state is efficiently susceptible. [4,5] Akinyanju (1989) reported an overall

carrier rate of 25% for Hb S in Nigeria. [6] Sickle cell disease is carried throughout much of Sub-Saharan Africa affecting up to 3% of births in some parts of the continent with an estimated childhood mortality of 50-90%. [7]

A report on sickle cell knowledge, attitude to premarital screening and marital decision among local government workers in Ile-Ife, Osun State, Nigeria, revealed a 60% poor knowledge with a favourable attitude to premarital screening. [8] A study among under-five mothers of Ekosodin community of Delta State, Nigeria, showed a low 21.7% prior knowledge of Hb phenotypes. [9] A 2010 study on SCD awareness, conducted among teachers, lecturers and health workers in Kano State, Nigeria, documented poor knowledge of SCA in 27.3%, while 73% understood it as an inherited disorder. [10] Poor knowledge of Hb phenotype was also demonstrated in a Sokoto study where 9.1% of the respondents selected blood group as phenotype and 55.1% suggested the prohibition of marriages between intending couples with the Hb S gene. [11] About 82% of secondary school students studied in Jos were aware of SCD. [12]

Nnaji and co-workers (2013) reported the haemoglobin electrophoretic pattern of premarital couples in Southeast Nigeria as 72.6%; AA, 26.4% AS and 0.94% SS with a high opinion of calling off the marriage when there was a risk of having Hb SS. [13] Gallo and colleagues (2010) reported the importance of being a sickle cell trait and knowing the haemoglobin phenotype of a partner in reproductive decision making. [14] Boulet *et al* (2013) in a Medicaid data base study, described various maternal complications in SCA patients including thrombosis, pulmonary embolism, obstetric shock, acute renal failure, cardiovascular accident, respiratory distress syndrome, eclampsia, post-partum haemorrhages, preterm birth and infections. [15] Costa *et al* (2015) also reported a higher caesarean rate, small for gestational age babies, low birth weight, baby admissions and maternal death rate among patients with SCD in their maternity. [16]

Several publications in circulations addressed knowledge and attitude of various groups in different settings to SCD. There is however, paucity of reports on this kind of study among students who are in training to become service care providers particularly in our setting. This study is therefore aimed at assessing the awareness, knowledge and attitude of fresh clinical students to SCD that may provide the basis for a training protocol, which will not only prepare would-be medical graduates to understand, recognise, diagnose and manage patients, but also equip them to exhibit attitudes effective for better care and disease control.

MATERIALS AND METHODS

This was a cross sectional study of fresh clinical students of the University of Jos. Participants were recruited consecutively after informed consent to participate in the research was obtained. A structured questionnaire was then administered to provide information on biodata, awareness, knowledge and attitude of the respondents to SCD. Three millilitres of blood from subjects who demonstrated positive attitude to knowing or confirming their haemoglobin phenotype was collected into EDTA bottles. Haemoglobin electrophoresis by cellulose acetate method at pH 8.4 was performed using standard operating procedure. Further commitment to positive attitude to SCD was determined by the number of voluntary blood that actually donated in the past by participants targeted at the transfusion needs of patients with SCD. Data was analysed using Epi-Info 2007 software. The ethical clearance for this work was obtained from the Ethical Committee of the Jos University Teaching Hospital, Jos.

RESULTS

Outcome on assessment of awareness and knowledge on sickle cell disease

One hundred and seventeen fresh clinical students of the College of Medical Sciences of the University of Jos, Nigeria, were studied. The age range of participants was 19-34 (23.7±2.9) years with a mode and median of 23. There were 80 (70.1%) males and 29.9% females. All the subjects (100%) were aware of SCD, 104 (88.9%) knew someone with SCD while 21.1% never knew anyone with the disease.

Awareness on sickle cell disease (SCD) was from multiple sources with health talk leading (Figure 1).

On the knowledge of SCD, 115 (98.3%) knew that both male and females are affected while 1.7% thought the disease is limited to females. A similar level of knowledge was observed for the mode of acquisition of SCD as 116 (99.1%) opined that it is an inherited disease. One hundred and six (90.60%) thought SCD affects Africans more, while 6 (5.1%) and 5 (4.3%) believed Americans and Asians respectively suffered more from the illness. On the physical health status of patients with SCD, 173 responses were elicited. Ninety five (54.9%) and 47 (27.1%) responses respectively indicated that persons living with SCD could be in the steady (relative health) or crisis state while a smaller number (18 %) opined that patients could enjoy a state of good health.

Fifteen (12.3%), 16 (13.7%), 31 (26.5%) and 55 (47%) of the respondents believed that the disease manifests before birth, at birth, in adult age and in children aged 3-6 months respectively. Pain, anaemia, jaundice and abdominal distension were known common clinical presentations to 97 (82.9%), 69 (59%), 69 (59%) and 42 (35.9%) students respectively. Participants responded differently and added to the tests that are used to diagnose SCD (Figure 2). Packed cell volume, full blood count, red blood cell sickling test, haemoglobin solubility test, enzyme linked immune-sorbent assay and nucleic acid test were respectively the opinions of 32 (27.3%), 19 (16.2%), 100 (84.4%), 30 (25.6%), 53 (42.3%), 7 (6%) and 29 (24.8%) respondents on the investigations required to diagnose SCD. Fifty nine (50.4%) of the respondents knew that SCD could be diagnosed in the ante natal period using intra uterine methods (Table 1). On the treatment of SCD, 98 (74.4%) knew that the cure could be obtain by haemopoietic stem cell transplant, while blood transfusion, fluids and drugs were the therapeutic options in 10.3%, 8.6%, and 6.8% respectively.

Outcome on assessment of attitude to sickle cell disease

The attitude of fresh clinical medical students in this study varied depending on questioned disposition. Sixty four (54.7%) had earlier tested and knew their haemoglobin phenotype as AA {53(41.9%)}, AS {11(9.4%)}, and SS {4(3.4%)}, while about half (45.3) of the respondents were ignorant (Figure 3). Eighty eight (75.2%), 88%, 82.9% and 78.6% are respectively favourably disposed to; disclosure of their haemoglobin protein type, caring for persons living with SCD, testing for or confirming their haemoglobin type and donate blood in aid of patients with SCD (Table 1). Only 27 (23.1%) are disposed to marrying a prospective partner with Hb S phenotype. Fewer students 27 (27.8%), who expressed willingness to tests for their Hb phenotype, committed by having their samples collected for Hb electrophoretic pattern (Table 1). Only 10 (15.6%) of the 64 subjects that “knew” their Hb phenotype agreed to be re-tested, while 17 (32.1%) of 53 subjects who “never knew” their Hb phenotype were tested. The outcome of Hb electrophoresis determination in 3 (27.3%) showed discrepancies in the “known” versus the determined. One (20%) of the 5 previously tested Hb AA was actually Hb AS, while one (25%) of four previously tested Hb AS was Hb AA and the only previously tested Hb SS who submitted was actually Hb AA. The 17 subjects tested without prior knowledge of their Hb phenotypes turned out to be Hb AA (47.1%) and Hb AS (52.9%). The combined frequencies of the Hb types for the 54 submitted and 27 determined were; 58 (71.6%) AA, 20 (24.7%) AS and 3 (3.7%) AS. Fourteen (12%) of all participants, making 15.2% of those who expressed disposition to donating blood targeted at the transfusion needs of SCD patients, actually donated.

DISCUSSION

Clinical medical students are those attending to the second part of their training following successful completion of the pre-clinical courses. This stage is the earliest part of clinical exposure which includes the introductory courses of pathology, medicine and surgery. The understanding of clinical entities, skills of evaluation and management created at this level may set the stage for further knowledge acquisition, effective clinical and community

services. Clinical trainees are expected to understand genetic disorders, the commonest being the sickle haemoglobinopathy.

Awareness and knowledge of sickle cell disease

The 100% awareness on SCD and the high rate of specific knowledge of a patient with SCA among respondents is similar to, but higher than 74.7% knowledge of children with SCA among mothers of under five in Ekosodin community of Delta State, Nigeria, respectively.[9] The high awareness of SCD in this study might be related to multiple sources of information available to this study population, being clinical students (Figure 1). Several sources of information identified in this study are similar to a 2009 Health Information National Trends Survey outcome. [17]

The high prevalence of the Hb S gene in our setting implies higher chances of marriages between individuals with the sickle cell trait with resultant births of children with homozygous inheritance. [4] There is therefore a need to expose health care providers in training on methods of public awareness creation in communities on SCD which should inform individuals and thus enhance community participation in an attempt to eliminate the disease without stigmatization. While it is established that SCD affects both male and female sexes without preference, a small fraction (1.7%) of the respondents in this study believed the disease affects only the female sex. [3] This is contrary to the genetics involved in the inheritance of SCD. [18] Our findings on the race affected by SCD, is similar to the work which reported the Hb S gene affecting 20-30% of people in Nigeria, Gabon, Ghana, Cameroon and the Republic of Congo. [4] While the majority of respondents knew that patients with SCD could be in a state of relative good health or crises, a minority of them (17.9%) thought the SCA patients could enjoy good health. Smith and colleagues reported that patients with SCD have pain more frequently than reported by doctors. [19] The knowledge gap of this minority may reflect a greater need for more awareness interventions in the community including the university where many young adults are training. These young adults are the target population requiring information of available options to make decisions bordering on their reproductive lives. There is also a need to expose clinical students regularly to patients with SCD in both steady state and crises to increase their knowledge and ultimately improve patient care.

The distortion in the knowledge of the respondents on the first time SCD should manifest is worrisome, as only a third of them opined that SCD manifest first within 3-6 months of life, while others thought the earliest presentation SCD could be intrauterine, at birth or in adulthood. The decline in foetal haemoglobin as a result of the switch from the synthesis of gamma to beta globin chain that occurs within the first 3-6 months of life explains why the affected children present first with variable symptoms to health service providers within this period. [20] The knowledge of these students on the common presenting features of SCD varies from 35-83% (Table 1). Pain which is the earliest presentation manifest as dactylitis (hand and foot syndrome) in children and bone pains in adults, are as a result of microvascular occlusion (VOC) and consequent osteonecrosis. [1] This acute complication is responsible for the destruction of long bones, skull, vertebral and digital bones of the extremities. [2] Chronic anaemia, a constant feature of SCD, is sometimes worsened by increase red blood cell destruction (hyper-haemolysis) or sequestration of blood into the reticulo-endothelial tissues (spleen, liver, bone marrow) or in severe cases may involve the adrenals. [2,3] Anaemia may infrequently be due to the switch off of the haemopoiesis sequel to infection of the erythroid progenitor cells by Parvovirus serotype B19, causing aplastic crisis. [2,3]

While packed cell volume confirms anaemia and determines its severity, it does not contribute information to the diagnosis of SCD as alleged by 27.3% of responses on the relevant investigations to diagnose SCD. Full blood count was the suggested test to diagnosed SCD by a sizeable proportion of respondents (Figure 2).

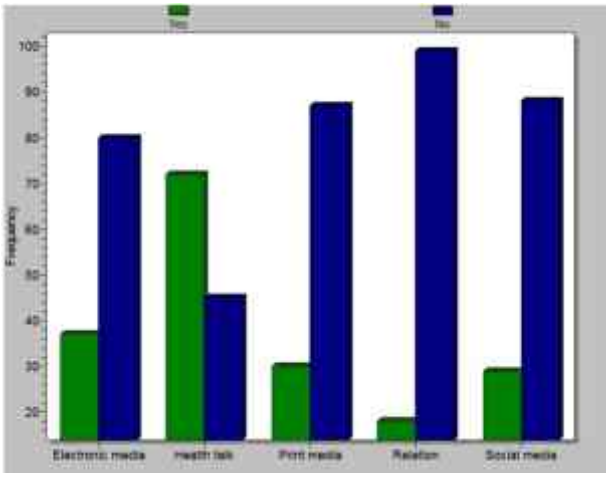


Figure 1: Sources of awareness of fresh clinical students of University of Jos on sickle cell disease

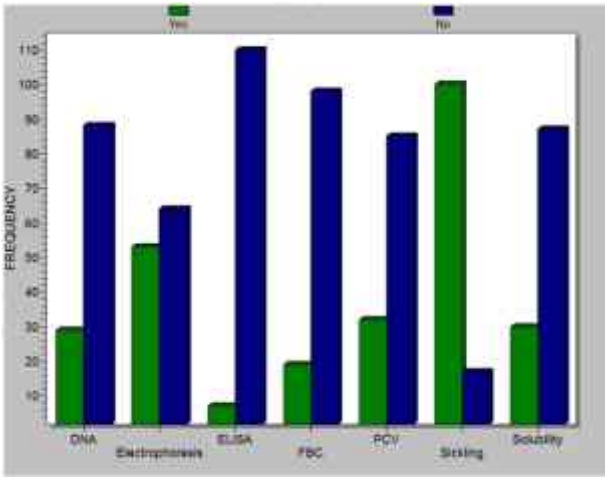


Figure 2: Knowledge of fresh clinical students of University of Jos on tests used in the diagnosis of sickle cell disease

Key: DNA = deoxyribonucleic acid (genetic material), ELISA = enzyme linked immunosorbent assay, FBC = full blood count, PCV= packed cell volume, SCD = sickle cell disease

Full blood count will reveal peripheral blood features such as sickled red blood cells, ovalocytes and target cells. Polychromatic cells, nucleated red blood cells, thrombocytosis and leucocytosis are features of enhanced compensatory haematopoieisis that occurs in haemolytic states. [2] Further evidence of compensatory haematopoiesis is the demonstration of reticulocytosis using supravital stain. [21] Screening tests (sickling and haemoglobin solubility tests) that strongly indicate SCD were known respectively to all, and two third of our subjects while haemoglobin electrophoresis, which is diagnostic of SCD is known to only two thirds of respondents. Enzyme linked immunosorbent assay and nucleic acid test were less popular among the respondents. The sickling test, a common, simple and routine investigation performed by support staff in the laboratory at various levels of healthcare in developing countries may be partly responsible for the wide knowledge of this disease. Haemoglobin solubility test, ELISA and NAT require increasing technical knowledge and material resources to carry out in increasingly sophisticated laboratories. [22] ELISA and NAT largely relevant in ante natal and neo-natal diagnosis of SCD are known to only 50% of respondents.

The management of individuals living with the sickle cell haemoglobinopathy whether homozygous or compound heterozygous disease can be supportive or curative. Majority (74.3%) of the students knew that haemopoietic stem cell transplant could cure SCD. The opinion of minority students that alleged intravenous fluids, drugs and blood transfusion as curative calls for long term plan to expose trainees not only to supportive care but also to haemopoietic stem cell transplantation and survivors of stem cell transplant in the course of their training.

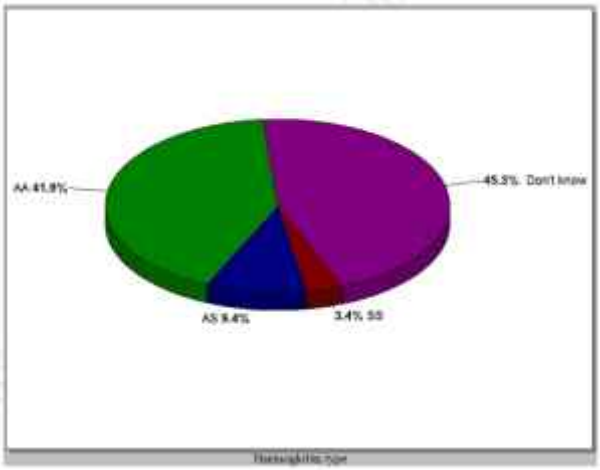


Figure 3: All previously known and unknown haemoglobin phenotypes of fresh clinical students of University of Jos.

Key: AA = normal haemoglobin, AS = sickle cell trait, SS = sickle cell anaemia

Table 1: Distribution of fresh clinical students of University of Jos, based on parameters on awareness, knowledge and attitude to sickle cell disease

Parameters	yes (%)	No (%)	Total (%)
SCD awareness	117 (100)	0 (0.0)	117 (100)
Hb type earlier known	64 (54.7)	53 (45.3)	117 (100)
Intra-uterine diagnosis	59 (50.4)	58 (49.6)	117 (100)
Hb status disclosure	88 (75.2)	29 (24.8)	117 (100)
Will to marry Hb S partner	27 (23.1)	90 (76.9)	117 (100)
Care for SCD patients	103 (88.0)	14 (12.0)	117 (100)
Blood donation for SCD	92 (78.6)	25 (21.4)	117 (100)
Will to test for Hb type	97 (82.9)	20 (17.1)	117 (100)
Tested for Hb type	27 (27.8)	70 (72.2)	97 (100)

Key: Hb = haemoglobin, SCD = sickle cell disease

Attitudes to sickle cell disease

Subjective attitudes and dispositions of respondents to SCD were impressive by the recorded intention to the disclosure of Hb phenotype, care for individuals with SCD, willingness to test for, or confirm Hb type and donation of blood in aid of SCD patients (Table 1). The willingness to marry a prospective partner with Hb S, expressed in less than a fourth of the respondents, mirrors the increasing rate of cancellation of marriage proposals among at risk intending couples in Saudi Arabia. [23]

Subjectively, more than half of the students in this study claimed knowledge of their Hb type, though only 15.6% of them agreed to retesting. The outcome of this retesting showed alarming discrepancy of 33.3%. Some clinical laboratory investigations that may be going on in substandard settings devoid of supervision and quality control could explain the discrepancy. There is need to educate would-be medical practitioners and other care providers in the health sector on regularized clinical reviews and investigations of patients including the investigations of genetic disorders. Regulatory government organs should ensure adherence to standard and quality in all clinical laboratories. The higher occurrence of Hb AS type (52.9%) among those who were tested for the 'first time', is surprising, but when combined the results of those who “knew” their Hb phenotype, the prevalence of Hb S normalised to 24.7%. [4,6] The discrepancies observed in this study suggest a need to confirm test results of haemoglobin phenotypes, obtained locally. Furthermore, the need to ensure adherence standard and quality in all clinical laboratory investigations for reliable results should be emphasised. Accredited laboratories that utilise more reliable methods such as high performance liquid chromatography (HPLC), iso-electric focusing (IEF) or polyacrylamide gel electrophoresis (PAGE) should be used. Availability of high technology electrophoresis methods in training institutions like ours would not only ensure more accurate Hb phenotype determination beyond the sickle globin, but also expose trainees to a better understanding of the phenotypes in the community. Health care providers should not lose sight of the disease potential of Hb AS associated with certain habits and predispositions. [24] The rate of expression of intention to donate blood and actual donation in this study is similar to our earlier findings documented among new student intakes of a tertiary institution in Plateau State. [25] This suggests that the intention to donate and act of donating of blood voluntarily, may not differ between specific identified needs and non-specific targeted donation requests.

CONCLUSION

We conclude that the awareness of sickle cell disease among fresh clinical students in our university is high. Despite the high positive subjective attitudinal disposition to sickle cell disease, actualizing expressed commitments may be low in this setting.

RECOMMENDATIONS

We recommend the inclusion of genetics and genetic diseases in the curriculum of both secondary and tertiary levels of education to create the needed awareness, knowledge and positive attitudes early in the life of young people. There is a need to train future health care providers and retrain existing ones on the current care of patients with SCD. Effective control measures would reduce the health, mental and social burdens of this disease on the family unit, society and government.

Acknowledgement

The authors wish to thank the management of University of Jos and that of the Jos University Teaching Hospital for creating the enabling environment for the successful completion of this work. We also want to appreciate our students for their cooperation in the course of this study which has contributed in no small measure to the overall success.

Limitations

None of the participants who claimed to know his or her Hb type had any traceable evidence for comparison.

We were limited to the alkaline cellulose acetate method due to non-availability and high cost of superior techniques.

Conflict of Interest:

The authors have no conflict of interest to declare.

Authors' Contributions:

All authors contributed to the study design, data collection and the writing of the manuscript.

REFERENCES

1. Weatherall DJ. Genetic disorders of haemoglobin. In: Hoffbrand AV, Lewis SM, Tuddenham ED. Editors. Postgraduate Haematology. 4th edd, Arnold, London. 2001: 91-119
2. Ernest B. The sickle cell diseases and related disorders. In: Ernest B, Marshall AL, Barry SC, Thomas JK, Uri S. Editors. Williams Haematology. 6th edd, McGraw Hill, Newyork, USA. 2001: 581-601
3. Disorders of Haemoglobin structure and synthesis. In: Sexana R, Pati HP, Mahapatra M. Editors. De Gruchys clinical haematology in medical practice. 6th edd, Wiley, Greater Noida, India. 2013: P 120-145
4. Sickle cell disease, prevention and control. WHO Nigeria. 2015. www-afro.who.int/en/Nigeria-publications/1775-sickle cell disease.html
5. Serjeant GR. The natural history of sickle cell disease. Cold Spring Harb Perpect Med. 2013; 3:a011783
6. Akinyanju OA. A profile of sickle cell disease in Nigeria. *New York academy of sciences.* 1989; 565: 126-136
7. Scott DG, Isaac O, Hani KA et al. sickle cell disease in Africa. *Am J Prev Med*. 2011; 41: 398-405
8. Emmanuel AA, Olubenga O, Ibrahim B, Osakwe C. Sickle cell knowledge, premarital screening and marital decision among local government workers in Ile-Ife. *African J Pri Health Care and Fam Med*. 2009; 1: 53-57
9. Abhulihen-Iyoba BI, Odwubono ME, Okolo AA. Awareness of sickle cell disease amongst mothers of under-five in Ekosodin community, Edo state, Nigeria. *Niger Hosp Pract*. 2011; 7: 104-109
10. Abubakar S, Lawan UM, Mijinyawa MS, Adeleke S, Sabiu H. Perceptions about sickle cell disease and its prevention among undergraduates of tertiary institutions in Kano state Nigeria. *Niger J Clin Med*. 2010; 13: 46-51
11. Isah BA, Yahaya M, Mohammed UK, Ibrahim MTO, Awosan RT, Yunusa EU. Knowledge and attitude regarding premarital screening for sickle cell disease among students of State School of Nursing, Sokoto. *Ann Intern Med Dental Res*. 2016; 2: 29-34
12. Olarewaju SO, Enwerem K, Adebimpe WO, Olubenga BA. Knowledge and attitude of secondary students in Jos, Nigeria, on sickle cell disease. *Pan African Med J*. 2013; 15: 127-123
13. Nnaji GA, Ezeagwuna DA, Nnaji IJF, Osakwe JO, Nwigwe AC, Onwura OW. Prevalence and pattern of sickle cell disease in premarital

couples in Southeastern Nigeria. *Niger J Clin Prac*t. 2013; 16: 309-314

14. Gallo AM, Wilkie D, Suarez M, Labotka R, Molokie R, Thompson A *et al*. Reproductive decision in people with sickle cell disease or sickle cell trait. *West J Nurs Res*. 2010; 32(8): 1073-1090
15. Boulet SL, Okoroh EK, Azonobi I, Grant A, Hooper WC. Sickle cell disease in pregnancy: maternal complications in a Medicaid enrolled population. *Matern Child Health*. 2013; 17(3): 200-207
16. Costa VM, Viana MB, Aguiar RA. Pregnancy in patients with sickle cell disease: maternal and perinatal outcomes. *J Matern Fetal Neonatal Med*. 2015; 28: 685-689
17. Redmond N, Baer HJ, Clark CR, Lipsitz S, Hicks LS. Sources of information related to preventive health behaviors in a national study. *Am J Prev Med*. 2010; 38: 620-627
18. How do people get sickle cell disease? Available at:sickle.bwh.havard.edu/scd_inheritance.html
19. Smith WR, Penberthy LT, Bovbjerg VE McClish DK, Roberts JD, Dahman B *et al*. Daily assessment of pains in adults with sickle cell disease. *Ann Intern Med*. 2008; 148: 94-101
20. Akinsheye A, Asultant A, Solovieff N, Nadia S, Duyen N, Clinton TB *et al*. Fetal haemoglobin in sickle cell anaemia. *Blood*. 2011: 118: 19-27
21. Satko R. Anaemia of abnormal globin development-Haemoglobinopathies. In: Stiene-Martin EA, Lotspeich-Steininger CA, Koepe JA (editors). Clinical haematology. 2nd edd, Lippincot, Philadelphia, Newyork, USA. P192-216
22. Zeuner D, Ades AE, Karnon J, Brown J, Dezateux C, Anionwu EN. Ante natal and neo-natal haemoglobinopathy screening in the UK: review and economic analysis. Health Technot Assess. 1999; 3: 186-191
23. Memish ZA, Saeedi M. Six years outcome of the national premarital screening and genetic counselling program for sickle cell disease and beta thalassemia in Saudi Arabia. *Ann Saudi Med Riyadh*. 2011; 3: 229-235
24. Damulak OD, Egesie OJ, Jatau ED, Pam SD, Onche II. Femoral head avascular necrosis in heterozygous sickle haemoglobin, the role of parenteral drug abuse: a case report. *IBBJ*. 2017; 3: 40-43
25. Damulak, OD. Jatau ED. Dacob D, Nohshuan S, Reng T. Awareness, knowledge and attitude of students of a Plateau State tertiary institution to blood donation. *Medical Science*. 2016; 20: 45-52.

KALCOGEN®

Filgrastim 300 mg

for better outcome

Simplifies Choice

- ✓ **Prevents** : infection, neutropenia
- ✓ **Modicies** : biological responses
- ✓ **Stimulates** : granulocyte production
- ✓ **Saves Life** : reduces time of neutropenia

Dose: 5 mg/kg body weight daily

KALBE