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Haemoglobin Genotype Status awareness of Some Nursing Parents receiving Neonatal immunization in Jos, North-Central Nigeria

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Abstract
Aims: *To investigate the relationship of age, sex, education, occupation, tribe and geopolitical zones on haemoglobin genotype (Hb) status awareness of Some Nursing Parents receiving Neonatal immunization in Jos, North-Central Nigeria.*
Settings and Design: *A quantitative, non-experimental descriptive study.*
Method: *A quantitative, non-experimental descriptive study involving 782 parents from Jos, North-central Nigeria nested in a Neonatal Haemoglobin Variants Screening Initiative (NHVSI) of infants receiving immunization.*
Statistical Analysis Used: *Data analysis was by use of Statistical Package for Social Sciences, version 23 (Chicago II, USA) software.*
Result: *A total of 782 participants were recruited comprising of 391 mothers and 391 fathers. Majority of the respondents did not know their status (57.8%).Of the factors affecting their awareness sex had no significant difference. Age showed that respondents less than 20years of age, had the highest don't know status (82.6%).Those with primary and non formal education had the highest don't know status (90% and 86.7%).Geopolitical zone northwest had the highest don't know (77.5%) and the highest don't know for tribes was the Hausa-fulani (82.4%).Lastly occupation showed that self-employed had the highest don't know.*
Conclusion: *This shows that more enlightenment campaign of Hb genotype and determined government drive to carry out a general Hb genotype screening of all citizens ≤ 20 years of age is needed especially the Hausa/Fulani of the Northern part of Nigeria. Therefore Parental genotype screening should be included in neonatal screening program.*

Introduction

Haemoglobinopathies or haemoglobin variant disorders (HVD) are the most common gene disorder worldwide with about seven percent of the world population being carriers of significant haemoglobinopathy. Despite the high burden of Sickle Cell Disease (SCD), Nigeria does not have a national newborn screening program for HVD [1]

For the development of a newborn screening program intended for the specific need of Nigerian health care, we aim at(a) determining the haemoglobin genotype status of some parents in north central Nigeria,(b) understand some factors that might be responsible for the pattern of haemoglobin genotype distribution, (c) its subsequent effect on neonatal screening.

Materials and Methods

This cohort study was nested within the Neonatal Haemoglobin Variants Screening Initiative (NHVSI) of infants receiving immunization. It was a qualitative, non-experimental descriptive study of parents.

The age group was controlled for the intention of enrolling those apparently healthy, non-symptomatic neonates for Haemoglobin variants screening using varying methods. To this, a pre-analytical family history of the parents was first gathered to enable enrolment of their infants into the new born screening program according to the recommendation of[2-3].

Three hundred and ninety one (391) mothers along with their male counterparts were recruited into this study. . Ethical clearance was obtained from the Jos University Teaching Hospital Ethical Committee (JUTH/DCS/ADM/127/XXVIII/1276) and validated in other research centres as required. The aims and objectives of the study were explained to the respondents verbally. A written consent was obtained from each participant before enrolment in the survey. All identifiers of the respondents were removed from the data collection tool to encourage the participants to give honest responses to them.

Health workers of the nursing and laboratory departments were recruited for the administration of consent forms and questionnaires. The infants' weights, temperature and general well being were checked by the CHO and paediatricians and subsequently sent for immunization if no health complications were observed while those with any questionable health issues were referred to the wards or given treatment by the Community Medicine Clinicians. On arrival for immunization of those within this age limit, consent forms were administered to the parents and those who completed the consent forms were issued questionnaires. This exercise took place in hospital based immunization centres from April, 2019 to July, 2019. This randomized sampling captured people from about thirty-two (32) states of the country dwelling in North-central Nigeria and it represented about 88.0% of the nation's thirty-six (36) states.

From the month of February, 2019 to April, 2019, an intern Medical Laboratory Scientist, Laboratory assistant and Community Health Officer that can speak English and Hausa were selected and trained on the administration and awareness talks of the Hb variants screening and its benefits as well as consent and questionnaire administration. The research principal investigator and the trained assistants conducted a cross-sectional non-experimental study of the neonatal Hb variants, screening parents on their self-reported Hb genotype status, age, resident address, states of origin, occupation and educational status. The survey data were first piloted and validated in ten (10) hospital based parents in the course of the training. At the end of July, a total of seven hundred and eighty two (782) participants had been recruited. These formed the study population. Data analysis was by use of Statistical Package for Social Sciences, version 23 (Chicago II, USA) software. Data presentation was in form of tables and charts. Frequencies, proportions and percentages were calculated for categorical variables. Results of continuous variables were expressed as means standard deviation (SD) and medians. Chi-square analysis was used to test for association between categorical variables while student t- test was used to test significant relationship between parametric and non-parametric continuous variables respectively. Test of significance was set at $p<0.5$.

Results

A total of 782 respondents completed the questionnaires and participated in this study. The study population comprised of 391 fathers (male) and 391 mothers (female). The modal age of the male was 31 – 40 years (52.9%) while the modal age of the female was 21 – 30 years (46.2%). The age range of the fathers is between 20 – 60 years while that the mothers ranged from 18 – 51 years. Majority of the study respondents had a form of tertiary education 445 (56.9%). A good number of

the respondents were either civil servants 231 (29.5%) or business men and women 232 (29.7%). The tribes of the respondents cut across major tribes in Nigerian with the Hausa/Fulani 336 (43.0%) dominating, followed by Plateau local tribes 305 (39.0%). All six geo political zones were represented in the study. (Table 1)

The respondents Haemoglobin (Hb) Genotype distribution shows that 75.8% were HbAA, 23.3% were HbAS, 0.9% were HbSS and Majority of the respondents 57.8% did not know their genotype(Table 2). Of the "Don't Know" class of respondents, 61.4% were males while 54.2% are females. At P<0.005, there was a statistical difference of their knowledge gap between male and female as P= 0.220(Table 3).

The age groups with least knowledge of their (Hb) genotype were those of ≤ 20 years accounting for 82.6% of their group while the most knowledgeable age group is 30-40(50.9%). There is a significance difference of their knowledge of Hb genotype in respect to age as the elder ones seem to know their Hb genotype more and p = 0.001 (Table 4).

A high percentage of those with primary education and non-formal education did not know their genotype (90% and 86.7%) while respondents with tertiary education 59.3% know their genotype. The (p < 0.005) of the knowledge and educational level attained is statistically significant different (Table 5).

The genotype knowledge when compared across tribes and geopolitical zones of respondents Table 6 and 7 showed a statistical significance (p=0.001). The Hausa/Fulani were the highest that did not know their genotype (82.4%).They occupy most of the North West and North Eastern zones which had the highest "Don't know" genotype status (77.5% and 71.8%) respectively [Table 6 and 7].

The relationship between respondents occupation and their knowledge of Hb genotype showed a statistical significance of (p = 0.001). The self-employed and the business group had the highest "Don't know" status (73.8% and 68.8%). While the civil servants had the least "Don't know" status (42.2%)[Table 8].

Table 1: Demographic characteristics of study participants

Demographic characteristics	Gender		
	Male (n=391)	Female (n=391)	Total (n=782)
Age group			
≤20	37(9.5)	32(8.2)	69(8.8)
21-30	34(8.7)	195(49.9)	229(29.3)
31-40	207(52.9)	154(39.4)	361(46.2)
41-50	96(24.6)	9(2.3)	105(13.4)
>50	17(4.3)	1(0.3)	18(2.3)
Educational level			
None formal	11(2.8)	4(1.0)	15(1.9)
Primary	22(5.6)	28(7.2)	50(6.4)
Secondary	112(28.6)	160(40.9)	272(34.8)
Tertiary	246(62.9)	199(50.9)	445(56.9)
Occupation			
Business	148(37.9)	83(21.2)	231(29.5)
Civil servant	148(37.9)	84(21.5)	232(29.7)
House wife	0(0.0)	119(30.4)	119(15.2)
Self-employed	32(8.2)	52(13.3)	84(10.7)
Student	6(1.5)	38(9.7)	44(5.6)
Unemployed	10(2.6)	7(1.8)	17(2.2)
Others	47(12.0)	8(2.0)	55(7.0)
Tribe			
Hausa/Fulani	167(42.7)	169(43.2)	336(43.0)
Igbo	14(3.6)	15(3.8)	29(3.7)
Yoruba	28(7.2)	26(6.6)	54(6.9)

Plateau tribe	151(38.6)	154(39.4)	305(39.0)
Others	31(7.9)	27(6.9)	58(39.0)
Geo-political zone			
North Central	273(69.8)	271(69.3)	544(69.6)
North East	34(8.7)	37(9.5)	71(9.1)
North West	41(10.5)	39(10.0)	80(10.2)
South West	24(6.1)	22(5.6)	46(5.9)
South East	14(3.6)	13(3.3)	27(3.5)
South South	5(1.3)	9(2.3)	14(1.8)

Table 2: Self-reported Haemoglobin (Hb) genotype of study participants.

Hb genotype	Frequency (n=782)	Percentage(%)
Known	330	42.2
Don't know	452	57.8
The knows(n=330)		
HbAA	250	75.8
HbAS	77	23.3
HbSS	3	0.9

Table 3: Association between knowledge of genotype and gender of study participants

Gender	Knowledge of genotype		χ^2	P
	Known	Don't know		
Male	151(38.6)	240(61.4)	4.110	0.043
Female	179(45.8)	212(54.2)		
Total	330(42.2)	452(57.8)		

Table 4: Association between knowledge of genotype and age of study participants

Age group	Knowledge of genotype		χ^2	P
	Known	Don't know		
≤20	12(17.4)	57(82.6)	32.029	0.001
21-30	91(39.7)	138(60.3)		
31-40	184(51.0)	177(49.0)		
41-50	37(35.2)	68(64.8)		
>50	6(33.3)	12(66.7)		

Table 5: Association between knowledge of genotype and educational level of study participants

Educational level	Knowledge of genotype		χ^2	P
	Known	Don't know		
None formal	2(13.3)	13(86.7)	126.791	0.001
Primary	5(10.0)	45(90.0)		
Secondary	59(21.7)	213(78.3)		
Tertiary	264(59.3)	181(40.7)		

Table 6: Association between knowledge of genotype and tribe of study participants

Tribe	Knowledge of genotype		χ^2	P
	Known	Don't know		
Hausa/Fulani	59(17.6)	277(82.4)	156.355	0.001
Igbo	25(86.2)	4(13.8)		
Yoruba	33(61.1)	21(38.9)		
Plateau indigene	183(60.0)	122(40.0)		
Others	30(51.7)	28(48.3)		

Table 7: Association between knowledge of genotype and geo-political zone of study participants

Geo-political zone	Knowledge of genotype		χ^2	P
	Known	Don't know		
North Central	231(42.5)	313(57.5)	52.079	0.001
North East	20(28.2)	51(71.8)		
North West	18(22.5)	62(77.5)		
South West	29(63.0)	17(37.0)		
South East	24(88.9)	3(11.1)		
South South	8(57.1)	6(42.9)		

Table 8: Association between knowledge of genotype and occupation of study participants

Occupation	Knowledge of genotype		χ^2	P
	Known	Don't know		
Business	74(32.0)	157(68.0)	45.608	0.001
Civil servant	134(57.8)	98(42.2)		
House wife	52(43.7)	67(56.3)		
Self-employed	22(26.2)	62(73.8)		
Student	23(52.3)	21(47.7)		
Unemployed	7(41.2)	10(58.8)		
Others	18(32.7)	37(67.3)		

Discussion

Early awareness and correct knowledge of one's Hb genotype could provide information that will guide decisions of potential marriage partners. This guided marriage choice will lead to reduced Hb variants carriers, child morbidity, mortality and improved national health burden;[4]. Although, no specific time has been identified for individuals self, correct-knowledge of Hb genotype but some opined that it be before marriage[5,6&7]. However,[1&2] were of the opinion that neonatal screening and documentation be employed for early awareness. This second opinion will aid in eradicating to a great extent the Hb variants disorders as some countries have almost achieved[8].

In the quest to determine the Hb genotype awareness status of parents in the north central Nigeria, general demographic information of the respondents was noted as above (Table 1). The age range of the respondents was 20-60 years (men) and 18-51years (women). This was slightly different from the report of[9], whose child bearing age of their study population or fertility age was 30-49(men) and 18-49(women), but was however in agreement with works of[10] whose respondents age were (<21->61 years) for both male and female. Very few respondents in our study had no formal education (1.9%) while majority had some level of formal education with those having tertiary education having the highest percentage (56.9%). This was contrary to the findings of[11], who had 7% tertiary education for the North-central zone. This might be explained by the rural setting study design of their study in contrast to our own urban setting design. However, it agreed with the findings of[12-13] whose tertiary educational status of the respondents parents are (39-42% female and 52-54.4% male) and (70.4% male and 58.3% female) respectively. Majority of respondents are gainfully employed either civil servants (29.7%) or business owners (29.5%) with only 2.2% being unemployed. The tribes of the respondents cut across the major tribes in Nigerian, with the Hausa/ Fulani rating highest (43%) while the Igbo were the least with 3.7% (Table 1). This was in keeping with the works of[14] were they had 78.1% and 6.7% for Hausa/Fulani and Igbo respectively. The higher rating of the Hausa/Fulani could be due to the fact that their work was done in Sokoto; (North-Western Nigeria) that is mainly dominated by the Hausa/Fulani. Similarly this present work was in the North-Central Nigeria that also has a high population of Hausa/Fulani though not as high as North-Western Nigeria. In as much as this work was done in North-central Nigeria, the

respondents' origins cut across the six geo-political zones of Nigeria (Table 1).

Table 2, shows the self-reported Hb genotype of child-bearing mothers and their spouses. Majority of the respondents did not know their Hb genotype (57.8% "Don't Knows"), while only 42.2% claimed to know their Hb genotype (42.2% "Knows"). The self-reported genotypes of those that claim to know their Hb genotype are as follows: AA-75.8%, AS-23.3% and SS-0.9% respectively. Our findings were similar to those of[15] (AA- 59.2%, AS- 11.1% and 40.8% don't know) also in agreement with[16] whose subjects had 19.2% misreported or misidentified genotype and 45% don't know cases while[17] had 36.2% don't know, 54% AA, 7.3% AS and 2.5% SS. These previous works captures results from the North-central and South-central zones. This knowledge gap of misreported, misidentified or unknown Hb genotype subsequently endangers the process of the fight against SCD and /or HVD in Nigeria. To overcome this knowledge gap the study seeks to find the relationships or association of reported Hb genotype to gender, age, educational level, tribe, geopolitical zone and occupation of the respondents.

Table 3 shows the association between knowledge of Hb genotype and gender. There was no statistical significant difference between male and female in relation to Hb genotype $P<0.005$. This shows that the knowledge gap was not sex dependant as evident from the results. This implies that being male or female does not give one the ability to know his/her genotype.

For the association of Hb genotype knowledge and the age groups of the respondent, there was a significant difference (table 4). Those with lower age limit of less than 20years of age had the highest "don't know" status and the middle age of 31-40 years had the least "don't know" status. The lower age group will possibly be representing the non-educated group or those with primary level educational status in this study as well as the unemployed respondents. The findings of other scholars in Nigeria like[12, 15, 18,&19] suggested that the middle aged group had better knowledge of Hb genotype than their younger counterparts. A probable explanation to this might be the rout of awareness of these respondents. . According to[12,17&18], the awareness is obtained while seeking admission into post primary school, higher institution, through media, during marriage, at work place or while seeking for job. It is obvious that most of this middle aged group had the indices of literacy and age maturity at their advantage. This implies that infants of younger and illiterate parents are at higher risk of being diagnosed only after manifestation of symptoms which increases their morbidity and mortality rate and increased health burden on the nation.

Education was another factor considered in respect to the knowledge of their Hb genotype and a significant difference was observed (table 5). The primary and non-formal educated respondents had the highest "don't know" status (90.0% and 86.7% respectively) and the tertiary education group had the least "don't know" status (40.7%). These findings were in agreement with the works of[14&25], and just like age, can be explained by the mode of awareness. It is evident that a definite effort should be made by the government & NGOs to encourage education and make it appealing to the region of the North-central Nigeria.

The association between the knowledge of Hb genotype to tribe and geo-political zone seem to be intertwined. They both showed a statistically significant difference (table 6 and 7). Hausa/Fulani had the highest don't know (82.4%) and Igbo with the least don't know (4%). Similarly North West, North East and North Central have the highest don't know status (77.5%, 71.8% and 57.5% respectively). Cultures that forbid female education and promote child marriages are common in Northern Nigeria where the Hausa/Fulani inhabit. Also, the practice of traditional medicines and less of hospital based anti-natal care with treatment also reduces their chances of knowledge of Hb genotype[20]. The tribe and geo-political location of the participants seem to affect their ability to know or have

awareness of their Hb genotype. This inference is from the fact that in our study, 82.4% of the Hausa/Fulani did not know their genotype and they occupied mainly the north-west and north-eastern zone of the country and they had 77.5% and 71.8% "don't know" rate which were the highest in the study group. This work is also in agreement with work of Isa from Sokoto[14], the north western Nigeria were 65.9% of their population did not have a good knowledge of SCD. Studies have shown that this group has the lowest educational level, highest girl-child marriage and more frequent old man to girl child marriage[20].

Finally, the association between knowledge of Hb genotype and occupation was statistically significant (table 8) showing self-employed having the highest don't know (73.8%) and civil servants with the least don't know (42.2%). These results are similar to those of age and education. The least don't know (civil servants) class of individuals fit into the middle-aged group, educated and have access to all forms of media and information technology. However, the highest don't know (self-employed) represent more of those with less formal educational class and uneducated group, lower class of the society that lacks access or understanding for the various means of genotype awareness. They mostly prefer herbal treatments and patronize traditional birth care givers private where most routine procedures are not usually followed or rather they rely on patients' reported parameters. These are in tandem with the postulated awareness pattern of [12&17].

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