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Factors associated with Congenital Abnormalities in North-East Nigeria: A Case Study of Al-Manzoor Diagnostic and Clinical Services, Bauchi, North-East, Nigeria

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Abstract

Congenital malformations are rare disorders, but the prevalence is on the increase globally due to access to imaging modalities, particularly ultrasound. Severe congenital abnormalities are not compatible with life leading to miscarriages while others cause fetal, neonatal, infant, and under-five morbidity and mortality. Ultrasonography provides a safe tool for the early diagnosis of congenital abnormalities in pregnancy.

This study used a quantitative cross-sectional approach to determine the factors associated with fetal congenital abnormalities in 11 pregnant women diagnosed by ultrasound between January and June 2019 in a private diagnostic center in Bauchi, North-East Nigeria. The primary data was collected using interview schedule and analyzed with statistical package for social sciences.

The most common anomaly (33%) was central nervous system abnormality (hydrocephalus - 75% and anencephaly - 25%). The congenital abnormalities were associated with fever in first trimester (100%), poverty (82%), being a housewife (82%), multigravida (73%), illiteracy (73%), 18-27 age group (55%), and ingestion of herbs in the first trimester (54%). Hydrocephalus was associated with ingestion of drugs and herbs in first trimester and maternal occupation; anencephaly with maternal occupation, spouse occupation, and poverty; fetal ascites with advanced maternal age >38 years and grand-multiparity; and multicystic dysplastic kidney disease with spouse occupation (p .05).

Health education, avoidance of drugs and herbs in first trimester, access to healthcare, family planning, and poverty alleviation will prevent congenital abnormalities, reduce feto-maternal morbidity and mortality, and improve maternal and child health in Nigeria and other developing countries.

Keyword: *Congenital Abnormalities, Factors, Pregnancy, Ultrasound, Nigeria.*

Introduction

Congenital abnormalities are a leading cause of infant morbidity and mortality globally with over 29% of neonatal deaths attributed to birth defects (Lehtonen et al., 2017). In Nigeria, congenital abnormalities are often detected after delivery at home and the diagnosis made when the newborn presents at a medical facility. Most pregnant women carrying fetuses with congenital abnormalities do not have access to antenatal care. Where antenatal care is available, most of the facilities do not provide ultrasound services.

With ultrasound services becoming available and affordable in Nigeria, the diagnosis of congenital abnormalities in pregnancy is on the increase. The early detection of congenital anomaly can help in planning the management of the abnormalities to improve feto-maternal survival.

The intake of herbs and non-prescribed drugs is prevalent in Nigeria (Igweze et al., 2019). This habit is particularly common in northern parts of Nigeria (Aliyu et al., 2015), and can predispose pregnant women in early pregnancy to congenital malformations (Ahmed et al., 2018).

Therefore, this study explored the factors associated with 11 cases of fetal congenital abnormality diagnosed by ultrasound during obstetric scan from January to June 2019 at a private diagnostic center in Bauchi, the state capital of Bauchi state, North-East, Nigeria.

Bauchi is the capital of Bauchi state, one of the 36 states in Nigeria. It was created in 1976 and has 23 local government areas. It is 396 km from Abuja, the capital city of Nigeria. It bordered by Yobe and Gombe states to the north, Taraba state to the east, Plateau state to the south, and Kano and

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Kaduna states to the west. It has diverse ethnic groups, a teaching hospital, a specialist hospital, a Federal University of Technology, many private hospitals, and primary, secondary, and tertiary government and private institutions.

Methods

This research was a cross-sectional study to explore the factors associated with the congenital abnormalities detected by obstetric ultrasound scan within a period of six months (January to June, 2019) at Al-Manzoor Diagnostic and Clinical Services center in Bauchi, North-East, Nigeria.

A retrospective cohort design would have been most appropriate for this study because congenital abnormalities are rare but matching the participants with controls of similar socio-demographic variables was not feasible. Therefore, the study adopted an analytical cross-sectional approach. A prospective study was not suitable because it would require a large sample size and follow up for at least nine (9) months, practically not possible with the limited time and resources, and academic and work demands.

The primary data was collected by two experienced research assistants who were competent sonographers using a structured interviewer-administered questionnaire. The survey instruments were questionnaires, ultrasound machines, and ultrasound reports. Personal data included age, sex, gravidity, occupation, spouse occupation, educational level, and spouse educational level.

The study population consisted of pregnant women who came for obstetric scan at Al-Manzoor Diagnostic and Clinical Services, Bauchi. The sample size was eleven (11) pregnant women diagnosed with fetal congenital abnormalities during ultrasound scan between January and June, 2019. The convenience non-probability sampling technique was used to select the sample, meaning only those with sonographic diagnosis of congenital abnormality were selected.

The data was captured in SPSS. The age was grouped into three at ten (10) year-interval: 18-27; 28-37; and 38 years and above. Gravidity was grouped into primigravida, Gravida 2-4 (multigravida), and Gravida 5 and above (grand multigravida). Qualitative data was coded into numeric values to enable statistical analysis. Religion and presence or absence of fever, drug use, herb use, family history, and congenital abnormalities were the nominal variables. Age group, gravidity group, educational status, and occupation were the ordinal variables. The independent variables were the socio-demographic variables and the absence or presence of congenital abnormality was the dependent variable.

The analysis involved univariate statistics, percentages, and cross-tabulation and X^2 test. The research questions and hypothesis were addressed using appropriate statistical tests. A Confidence Level (CL) of 95% and a Level of Significance of 0.05 were used for the analysis. When p-value was < 0.05, the null hypothesis (H_0) was rejected, and research hypothesis accepted.

The main limitation was the small sample size and the absence of control to validate a classical retrospective cohort study which could have explored a causal relationship. Other limitations were exclusion of pregnant women less than 18 years old for ethical reasons, time and resources constraints, and low statistical power because of small sample size. Approval for the study was obtained from Al-Manzoor Diagnostic and Clinical Services, Bauchi. All participants were anonymous and gave informed consent.

Results

The socio-demographic profile of the participants is summarized in Tables 1. The age-range was 20 to 40 years, the mean age was 27.4 ± 6.5 years, 55% participants were within 18-27 age-group, 36% within 28-37, and 9% were > 38 years old. The gravidity ranged from 2 to 10 with 73% carrying 2-4th pregnancy and 27% carrying 5th and above pregnancy. Most of the participants were illiterate (73%), followed by primary education (18%), and the remaining 9% had junior secondary school education, while 55% of their spouses were literate. All of the participants were Muslims with 82% being full-time housewives and 82% of their spouses were petty traders, small-scale farmers, or artisans. Eighty-two (82%) of households were living below the poverty line of < $2 per day.

No participant or spouse was smoking or drinking alcohol, but 54% of the participants took herbs in first trimester (Figure 1). All of the participants (100%) had fever in the first trimester. There was no family history of congenital abnormality in 91% of the participants and 100% of the spouses.

The identified congenital abnormalities were hydrocephalus (25%), fetal ascites (17%), hydrops fetalis (17%), anencephaly (8%), multicystic dysplastic kidney disease (8%), prune-belly syndrome (8%), amelia (8%), and cystic hygroma (8%) as shown in Table 2. Central nervous system abnormalities constituting 33% were the most common anomaly (Figure 2).

The observed congenital abnormalities were associated with fever in first trimester (100%), poverty, < $2 per day (82%), being a housewife (82%), multigravida (73%), illiteracy (73%), 18-27 age-group (55%), and ingestion of herbs in the first trimester (54%) as shown in Table 3. Hydrocephalus was associated with intake of drugs or herbs in first trimester (OR 2.5, 95% CI .86, 7.31, p .013) and maternal occupation (OR 2, 95% CI .50, 7.99, p .047). Anencephaly was associated with maternal occupation, spouse occupation, and poverty (OR 2, 95% CI .50, 7.99, p .047). Fetal ascites was associated with advanced maternal age > 38 years (p .03) and grand-multiparity (OR 3, 95% CI .6, 14.8, p .010) while multicystic dysplastic kidney disease was associated with spouse occupation (OR 2, 95% CI .50, 7.99, p .047) – Table 4.

Discussion

Congenital anomalies are abnormalities that occur during intrauterine life and are detected either prenatally, at birth or later in life (WHO, 2019). The underlying cause of congenital malformations include genetic defects and chromosomal disorders, environmental factors, and nutritional deficiencies (Kalliora et al., 2019). Some of the genetic insults are hereditary, but environmental factors are known to cause chromosomal damage and induce congenital abnormalities in early pregnancy (Chang et al., 2019).

These environmental factors include physical agents such as ionizing radiation (Warembourg et al., 2017), biological agents like TORCH syndrome (Sunitha et al., 2017), chemical factors such as drugs, toxins, and herbs (Foster et al., 2017), and others factors like advanced maternal age associated with Down's syndrome (Frederiksen et al., 2018) and folic acid deficiency associated with neural tube defects (Welderufael et al., 2019).

All the observed congenital anomalies were associated with fever in first trimester. Fever in early pregnancy may be caused by teratogenic viral infections such as TORCH syndrome as demonstrated by Sunitha et al. (2017) (OR = 4.45, p= 0.009). Poverty, defined as daily household income of < $2 per day, was related to 82% of the anomalies. A similar association was reported by Adeboye et al. (2016) in Bida, North-Central Nigeria. Illiteracy, seen in 73% participants and being a housewife in 82% could synergistically translate into household poverty especially in the area of the study where unemployment is very rampant and women are not working class, and therefore, do not contribute to household income.

Multigravidity correlates with advanced maternal age, and both were found to be significant predictors of congenital anomaly as reported by Frederiksen et al., (2018) where maternal age of 40 years or older had a higher risk of chromosomal abnormalities (3.83% vs 0.56%, OR 7.44, CI 5.93 - 9.34) when compared with 20 - 34 age group.

The intake of drugs and herbs in the first trimester was significantly associated with hydrocephalus. Okoro et al., (2018) observed an associated between congenital abnormalities and herbs intake in pregnancy in South-East Nigeria. Similarly, Foster et al. (2017) alluded to this finding in a critical literature review of 97 studies involving various congenital anomalies including hypospadias, cryptorchidism, anogenital anomalies, congenital heart defects, oral clefts, neural tube defects, limb deficiency defects and gastroschisis.

The significant associations between central nervous system and kidney abnormalities with maternal and spouse occupation could be related to soil contamination by pesticides as asserted by García et al., (2017) where they observed congenital anomalies were associated with pesticides use. Since farming and artisan jobs (besides being a full-time housewife) were the most prevalent occupation in both participants and their spouses, contact with pesticide contaminated soil could be the underlying factor.

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The finding of central nervous system abnormalities as the most common anomalies (33%) tallies with findings in other studies (Eke et al., 2016; Goetzinger et al., 2017; Jystad et al., 2017; Sefidbakht et al., 2016). In a large prospective study of 3 years involving over 3000 participants in Hyderabad, south India, Sunitha et al. (2017) found that central nervous system malformations were the most prevalent congenital abnormality (37%), though Okoro et al. (2018) in South-East Nigeria observed that central nervous system anomaly was second to gastrointestinal malformations.

Conclusion

Having achieved the objective of this study of determining the factors associated with congenital anomalies in 11 pregnant women attending Al-Manzoor Diagnostic and Clinical Services, Bauchi, North-East Nigeria and based on findings from the study, the following recommendations are given to reduce the occurrence of congenital malformation and improve feto-maternal morbidity and mortality in Nigeria:

1. All pregnant women having fever in the trimester should seek medical attention at approved medical facilities.
2. The intake of drugs and herbs should be discouraged through regular public health campaigns using traditional leaders, politicians, footballers, and celebrities and various media outlets such as television, radio, social media, posters, and pamphlets.
3. Farmers and artisans should use protective gloves and boots when in contact with soil.
4. Sale and use of pesticides and herbicides should be regulated by the relevant government authorities.
5. Pregnant women should be encouraged to do antenatal care and be given incentives such as free delivery kits and free antenatal services.
6. Free medical care of pregnant women diagnosed with malformed babies.
7. Government should bring up various poverty alleviation programs and employment opportunities.
8. Establishment of antenatal clinics and provision of ultrasound facilities and training of midwives on the conduct of basic obstetric ultrasound scan.
9. Establishment and scaling up of family planning services especially in rural areas.
10. These recommendations would go a long way in preventing congenital anomalies, enhancing the early detection of congenital malformations, improving feto-maternal and child care, reducing infant and child morbidity and mortality, and improving feto-maternal survival and standard of living.

Figures and tables

Table 1. Summary of the socio-demographic profile of the participants

Socio-demographic profile of the participants					
Age (years)	**Mean ± SD**	**Median**	**Mode**	**Minimum**	**Maximum**
	27.4 ± 6.5	25	20	18	40
Age group	**18-27**		**28-37**		**≤ 38**
	55%		36%		9%
Gravidity	**Primigravida**		**Multigravida (2-4)**		**Grand Multigravida**
	0%		73%		27%
Educational Level	**Illiterate**		**Primary**		**Junior Secondary**
	73%		18%		9%
Occupation	**Housewife**				**Others**
	82%				18%
Household Income	**< $2 per day**				**> $2 per day**
	82%				18%

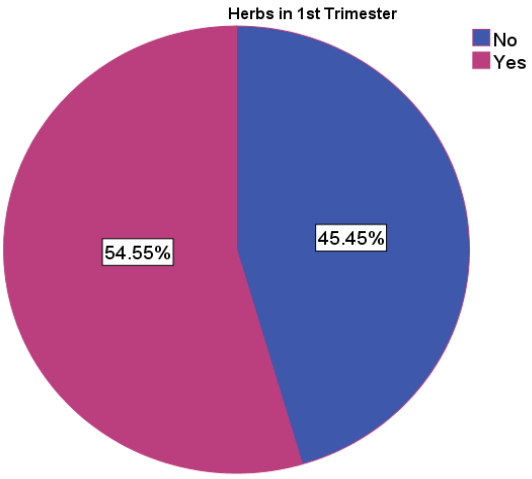

Figure 1. Use of Herbs in First Trimester

Table 2. Frequency of congenital abnormalities

Congenital Abnormality	Frequency	Percentage
Hydrocephalus	3	25%
Fetal Ascites	2	17.5%
Hydrops Fetalis	2	17.5%
Anencephaly	1	8%
Multicystic Dysplastic Kidney	1	8%
Prune-Belly Syndrome	1	8%
Amelia	1	8%
Cystic Hygroma	1	8%
Total	12	100

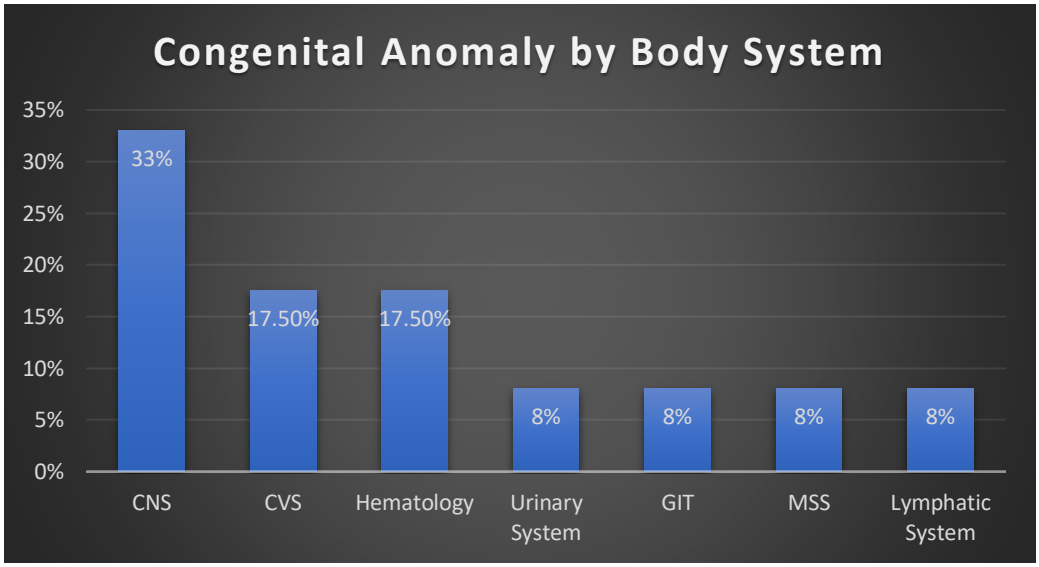

Figure 2. Frequency Distribution of Congenital Anomalies according to Body Systems

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Table 3. Factors associated with congenital abnormalities

Associated factors	Percentage frequency
Fever in the 1st trimester	100%
Poverty (< $2 per day)	82%
Being a housewife	82%
Multigravida (2-4 pregnancies)	73%
Illiteracy	73%
18-27 age group	55%
Use of herbs in 1st trimester	54%

Table 4. Significant factors associated with individual congenital abnormalities

Predictors	**Outcome**	**X^2/LR Value**	**df**	**P**	**Effect size**	**Standardized Residuals**	**Odds Ratio 95% CI**
Age > 38	Fetal Ascites	4.712	1	.030	.736 (p .051)	1.9	-
Grand Multiparity	Fetal Ascites	6.612	1	.010	.770 (p .011)	2.0	3(.6-14.8)
Occupation	Hydrocephalus	3.929	1	.047	.671 (p .026)	1.9	2(.5-7.99)
Occupation	Anencephaly	3.929	1	.047	.671 (p .026)	1.9	2(.5-7.99)
Spouse Occupation	Anencephaly	3.929	1	.047	.671 (p .026)	1.9	2(.5-7.99)
Spouse occupation	MDKD	3.929	1	.047	.671 (p .026)	1.9	2(.5-7.99)
Poverty > $2	Anencephaly	3.929	1	.047	.671(p .026)	1.9	2(.5-7.99)
Drug Use	Hydrocephalus	6.161	1	.013	.671(p .026)	1.4	2.5(.86-7.31)
Herbs Use	Hydrocephalus	6.161	1	.013	.671(p .026)	1.4	2.5(.86-7.31)

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