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Editorial comment

Gender-based studies in Africa and matters arising

It is share coincidence that about half of the papers in this issue of the journal focus on gender issues albeit without gender balance as publications on maternal aspects predominated. They covered cross-cutting issues like gender-based violence in Northwestern Ethiopia; preferred contraception methods in men and/or dislike of vasectomy; ethics of assisted reproduction; functioning during menopause; blood grouping to cater for transfusion needs in pregnancy and maternal mortality estimates for Nigeria.

Of special interest is the paper by Akinyemi and colleagues on the derivation of maternal mortality estimates from the 2012 National HIV/AIDS and Reproductive Health Survey. The rate derived using that data gave an all-time low figure of 256 per 100,000. Hitherto, the rates (per 100,000) had hovered between 1200 in 1990 and 560 in 2013 as noted by Akinyemi et al in that paper. The latter study utilized the National Demographic and Health Survey data. The new rates will make Public Health pundits raise their fists in victory that something seems to be working right with regards to reducing the high maternal mortality figures. Whatever these may be, we will like to know. The paper adduced possible explanation for the lower rates in the latest analysis and ended with suggestions on strategies for improving maternal mortality statistics in Nigeria. These include improvement in data collection which requires political will for doing it right and accurately; inclusion of questions on maternal death in census data acquisition and lastly, conduct of national maternal health survey.

A note of caution should be sounded when surveys are being planned because of various confounders. The source of the data is important as well as those involved with data gathering. This is best captured in the words of the British Statistician, Sir Josiah Stamp [1]: "The governments are very keen on amassing statistics – they collect them, add them, raise them to the nth power, take the cube root and prepare wonderful diagrams. But what you must never forget is that every one of those figures comes in the first instance from the village watchman, who puts down what he damn pleases."

It is anticipated that these set of papers on gender issues will generate discussions and lead to more studies. The journal will publish any reactions or comments on these papers as Letters to the Editor in subsequent issues of the journal. Reawakening interest in gender-based issues will be in line with the realization of some sustainable development goals.

Reference

1. Stamp J. Some economic factors in modern life. King, London. pp.258-259

A. Ogunniyi
Editor-in-Chief

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Magnitude and correlates of gender-based violence among married women in Northwest Ethiopia

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Abstract

Background: Gender-based violence (GBV) is a major public health and human rights problem with multiple sexual and reproductive health complications worldwide. This study was conducted to assess the magnitude of gender-based violence and its associated factors among married women in Northwest Ethiopia.

Methods: A community-based cross-sectional study was conducted from January to June 2015 using the World Health Organization multi-country questionnaire to measure violence against women. Trained data collectors interviewed 832 married women were selected by systematic random sampling technique. Epi info version 6.0 for data entry and SPSS version 20 for analysis were used. Data were principally analyzed using descriptive statistics, binary logistic regression.

Results: Six hundred and twenty (74.5%; 95%CI: 71.5%-77.3 %) of the married women had experienced at least one type of GBV in their lifetime and 41.8% (95%CI: 38.3%-45.1%) in the last 12 months. GBV included psychological violence in a life time 62.3% and in the last 12 months 35.6%; physical violence in life time 56.1%and in the last 12 months 27.9%; and sexual violence in life time30.6%, and in the last 12 months 15.5% were reported. Older women those in multiple sexual partnership or union, stayed in relationship or in union with their husband for ≤10years, age difference with their current husband of ≥5years, early child marriage, offer of sexual intercourse for monetary gains or for business purpose and alcohol intake were factors associated with an increased risk of gender-based violence.

Conclusions: Gender-based violence was found to be high and a serious problem among married women in Northwest Ethiopia. Comprehensive community based health education program and strengthening of women empowerment are necessary to improve this situation.

Keywords: *Gender-based violence, married women, prevalence, risk factors, Ethiopia.*

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Résumé

Contexte: La violence basée sur le genre, (VBG) est un problème majeur de santé publique et de droits de l'homme avec de multiples complications pour la santé sexuelle et reproductive dans le monde entier. Cette étude a été menée pour évaluer l'ampleur de la violence basée sur le genre et ses facteurs associés parmi les femmes mariées du nord-ouest de l'Éthiopie.

Méthodes: Une étude transversale communautaire a été menée de janvier à juin 2015 à l'aide du questionnaire multi-pays de l'Organisation Mondiale de la Santé pour mesurer la violence à l'égard des femmes. Les collectionneurs de données qualifiés ont interrogés 832 femmes mariées qui ont été sélectionnés par une technique systématique d'échantillonnage aléatoire. Epi info version 6.0 pour la saisie des données et SPSS version 20 pour l'analyse ont été utilisés. Les données ont principalement été analysées à l'aide de statistiques descriptives, de régression logistique binaire.

Résultats: six cent vingt (74,5%; 95% IC: 71,5% à 77,3 %) des femmes mariées ont connu au moins un type de VBG au cours de leur vie et 41,8% (IC 95%: 38,3% - 45,1%) au cours des 12 derniers mois. La VBG y compris la violence psychologique au cours de la vie 62,3% et au cours des 12 derniers mois 35,6% ; la violence physique au cours de la vie 56,1% et au cours des 12 derniers mois 27,9%; et la violence sexuelle au cours de la vie 30,6%, et au cours des 12 derniers mois 15,5% ont été signalés. Les femmes âgées ceux qui étaient dans une alliance ou union sexuelle multiple, restaient dans la relation ou en union avec leur mari pendant ≤ 10 ans, différence d'âge avec leur mari actuel ≥ 5 ans, mariage prématuré, offre de rapports sexuels pour des gains monétaires ou à des fins commerciales et la consommation d'alcool étaient des facteurs associés à un risque accru de violence basée sur le genre.

Conclusions: la violence basée sur le genre s'est révélée élevée et un grave problème chez les femmes mariées dans le nord-ouest de l'Éthiopie. Un programme complet d'éducation sanitaire communautaire et un renforcement de l'autonomisation des femmes sont nécessaires pour améliorer cette situation.

Mots-clés: *Violence basée sur le genre, femmes mariées, prévalence, facteurs de risque, Ethiopie*

Introduction

Gender-based violence (GBV) refers to all forms of violence that happen to women or girls and men or boys because of unequal power relations between them and the perpetrators of such violence. It derives from cultures, norms, social structures, and gender norms that influence women's vulnerability to violence [1, 2]. Despite the growing recognition of GBV as public health and human rights concern, as well as the obstacle it poses for development, it continues to have an unjustifiable low priority on the international development agenda [1].

World Health Organization (WHO) has recognized gender-based violence as a heavy health burden for women aged 15 to 44 years, similar to the risk posed by HIV, tuberculosis, infection during childbirth, cancer and heart disease. Gender-based violence has profound adverse consequences on women's physical, mental, and reproductive health. It is one of the most widespread human rights abuses that endangers the physical integrity and emotional well-being of victims particularly women and girls across the world [3].

No country is untouched by gender-based violence. It is on our streets, in our homes, schools, work places and institutions [4]. Globally, at least one in every three women is beaten, coerced into sex or abused in her lifetime [5]. According to a systematic review conducted in more than 50 population-based surveys across the world, the current estimate indicates that between 8% and 70% of women worldwide have been sexually assaulted by a male partner at least once in their life time and about 10%-50% of women were physically beaten by their own intimate partners [4].

In the United States of America (US), between 25% - 30% of married women have experienced some form of spousal abuse at some point in their marriage [3]. A study conducted in Italy (10.2%), Cambodia (16%), India (30%), USA (28%), Vietnam (17.0%) and Columbia (19%) showed that married women had experienced physical and sexual violence in the last 12 months by their husbands [6-9]. In the African countries, 46% of women in Uganda, 42% of Kenyan women, 60% of Tanzanian women, 40% of Zambian women and 35 % of women in Egypt had experienced gender-based violence [7, 10].

In Ethiopia more than two-thirds (68%) of married women have reported having experienced some form of physical or sexual violence by their husbands/partners. Although it declined from 81% in 2004, it is still highly prevalent [11, 12]. Different studies conducted showed high prevalence of gender-based violence such as in Butajira, Southwest Ethiopia, the magnitude of physical violence among women was 45% in lifetime and 10% in the last 12 months [13]. In Wollega, West Ethiopia, the prevalence of intimate partner violence against women was 76.5% in lifetime and 72.5% in the last 12 months [14]. In Jimma, Southwest Ethiopia, the prevalence of sexual or physical partner violence, or both (64.7%), sexual violence alone (50.1%) and physical violence alone (41.1%) in life time [15]. In Tigray, North Ethiopia, the prevalence of physical violence in the last 12 months and lifetime were (25.5%) and (31.0%) respectively [16], and in Gondar, Northwest Ethiopia, women who ever experienced physical, sexual, and/or psychological abuse were 50.8 %, physical violence 32.2% and forced sex19.2% [17].

According to the World Health Organization (WHO), violence is the result of the complex interplay of individual, relationship, social, cultural and environmental factors. The environment and social norms as the factors that may condone violence, however, are examined and reported infrequently [1]. Many kinds of psychosocial factors also increase women's vulnerability to gender based violence. These include age, alcohol or drug consumption, previous history of abuse, number of sex partners and involvement in sex work, poor educational level and socioeconomic status, history of childhood sexual abuse, having multiple partners, and exchanging sex for drugs, money, or poor shelter [18-20]. Alcohol consumption was the major attribute of violent partners [16, 17].

A systematic review conducted in several counties showed that a young age at first marriage is related to women's experience of gender-based violence [21]. In Bangladesh, most of the girls are married-off at their teen ages. Their decision making status as young wives is usually poor; that results in women married at teen ages being more victimized than those married at adult ages [22].

A study conducted in Ganji, West Ethiopia showed that early marriage significantly increased the risk of GBV [23]. A study done in East Wollega, Western Ethiopia showed older women were nearly four times more likely to report the incident of GBV [14] and in Bangladesh in which women older than 20 years were more likely to experience GBV and sexual violence [24].

Despite increasing recognition given to gender-based violence as a global public health problem, community-based studies that examine or indicate the prevalence of gender-based violence and its associated factors among married women in developing countries remain scarce. Therefore this

study was conducted in order to investigate the problem furthermore and address research gaps among married women. Data on gender-based violence are limited in Ethiopia, especially “the why and how” it occurs in the study area. Most community data are not reviewed in a timely manner and made available for decision makers. Thus, understanding the magnitude of the problems and the reasons behind gender-based violence among married women is crucial for program planer to design effective preventive strategies.

Methods

Study setting

This cross sectional study was conducted from January to June 2015 in Debre Tabor town, which is a capital city of South Gondar Administrative Zone, Amhara regional state, Northwest Ethiopia. The town is found 99 Kms away from Bahir Dar City and 667 Kms away from Addis Ababa. According to the central statistical agency (2010), the population of Debre Tabor town is about 78,703 (Male=37, 682, Female=41,021).The town has 4 kebeles, one government university and four colleges, one general hospital, four health centrer, six health posts, ten private clinics and six pharmacy shops. The population is predominantly ‘Amhara’ in ethnicity and Orthodox Christian.

Study design and sampling procedure

A community based cross sectional study using quantitative method of data collection was employed. All married women found in Debre Tabor town during data collection period were recruited as the source population for the study. The study populations were married women residing in town and those who were resident for at least six months preceding the survey. A multistage random sampling technique was used to select households from the community. In this study area there are four ‘’*Kebele*’’. Initially two “*Kebeles*” were selected by using simple random sampling and the sample size was proportionally allocated for these *Kebeles*. Then, study participants in the households were selected within each selected *Kebeles* using the systematic random sampling technique in every 5th household. Finally, one eligible respondent was selected from each household. In the presence of more than one eligible respondent in the household one of them were selected by a lottery method and in the absence of eligible respondent in the given household no substitution was made. The sample size was calculated using a single population proportion formula. By using the proportion from previous study conducted in Jimma, Southwest Ethiopia which showed that the prevalence of sexual violence among women was 50.1% [15] with 95% confidence interval, 5% degree of precision and design effect is 2 while 10% was added for non-response and the final calculated sample size was 845. The sample size was proportional to the size of the households in the two selected *kebeles*.

Data collection process

Data were collected using anonymous closed ended structured questionnaire. It was adopted from WHO questionnaire on domestic violence and intimate partner violence developed for a multi-country study on women’s health and gender-based violence [3], and the Ethiopian Demographic Health Survey (EDHS) questionnaire prepared for women’s health [12] elsewhere, to address the objectives of the study. In order to keep consistency and make the findings extremely comparable, it was prepared in English version and then translated into Amharic language and back translated in to English. Ten percent of questionnaires were pre tested to check for consistency as well as for coherence and amended accordingly. The questionnaire contained different questions to assess the socio-demographic characteristics, sexual behaviour such as types of marriage, duration of relationship or in union with current husband, age differences with current husband, age at first time of marriage, voluntary engagement in the first sexual intercourse, offered sexual intercourse for monetary gains or business purposes, substance use such as alcohol intake and Khat chewing, experience of gender-based violence(psychological, physical and sexual violence).

Data was collected through face to face interviews with married women. Written informed consent was obtained from respondents before the interview. Data collectors were six female nurses who could speak the local language (Amharic) and collected the information by going from house to house. Two supervisors were also recruited based on their previous field experience with household surveys. Two days intensive training was given to the data enumerators on how to collect data, when and how to make an interview and about ethical issues emphasizing on the importance of safety of participants and data quality.

Measurements

In this study, the definition of violence given by the WHO was adopted [1, 3]. To get the outcome of interest lifetime and 12 months experience of gender-based violence among married women was ascertained. Psychological, physical and sexual violence were measured for lifetime and for the last 12 months prior to the survey. Psychological violence was measured using 5 acts (insulted her or made her feel bad about herself, belittled or humiliated her in front of other people, done things to scare or intimidate her on purpose (e.g. by the way he looked at her, by yelling and smashing things), threatened when asking her friends/family, threatened to hurt her or someone she care about). Physical violence was measured using 4 acts (slapped her or thrown something that could hurt her, pushed her or shoved her or pulled her hair, kicked her, dragged her or beaten her up, hit her with his fist or with something else that could hurt her, choked or burnt her on purpose and threatened to use or actually used a gun, knife or other weapon against her). Sexual violence was measured using four acts (physically forced to have sexual intercourse when she did not want to, had sexual intercourse when she did not want to because she was afraid of what partner might do ,had unwanted sex position and had unwanted warm up for sex). The lifetime prevalence of gender-based violence was then defined as the proportion of married women who reported having experienced one or more acts of psychological, physical or sexual violence by a current or former partner at any point in their lives. Current prevalence is the proportion of married women reporting at least one act of psychological, physical or sexual violence during the 12 months before the interview.

Statistical analysis

The filled questionnaires were checked for completeness and consistency then data was entered to Epi-Info version 6 and exported to SPSS version 20 for analysis. Descriptive analysis such as frequencies, percentages, tables, figures were used to display the results. Bivariate logistic regression was done between each independent variable and outcome of the interest to assess statistical association. Binary logistic regression analysis was employed to measure dichotomous variables then all variables entered to multiple logistic regressions were performed to identify the most significant predictor of gender-based violence and to control for confounders with Enter method and simultaneously the Hosmer-Lemes how goodness of-fit test was checked. Adjusted odds ratio and confidence interval with 95% confidence limits and significance level ($P < 0.05$) was used to determine level of significance. The prevalence of gender-based violence was estimated for two time frames: the 12 months preceding the interview and any time during the woman's life from the time she started relationship with their husband/ intimate partner.

Ethical consideration

Ethical clearance was obtained first from getting approval from the Department of Obstetrics and Gynaecology, University of Ibadan and Pan African University Institute of Life and Earth Sciences (PAULESI). The request letter for data collection was submitted to South Gondar Zone Health Department (SGZHD); in turn they sent the letter to pertinent bodies to get approval for data collection. The importance of the study was explained to each respondent then written consent was obtained and assurance was given about the confidentiality of the responses taking into account the guidelines on ethical and safety recommendations for research on domestic violence against women (25).

Results

Socio-demographic characteristics

Out of 845 study participants counseled, 832 participated in the study giving response rate of 98.5%. Among respondents 301 (36.2%) were within the age group 25-34 years and 98 (11.8%) were 55 years and above with the mean age of 37.64years (SD±12.75). Among all participants 570(68.5%) had previously resided in urban area. Majority, 695(83.5%) of the participants were Christians. Regarding the ethnic profile of study, majority 788 (94.7%) of them were Amhara. Concerning the educational status 438(52.6%) of them had not attended formal education, 246(29.6%) had attended primary education, 119(14.3%) had attended secondary education and 29(3.5%) had attended higher education and above. Three hundred and seventy seven (33.3%) were employed. Two hundred and fifteen (25.8%) earned less than 560 Birr ($27) family income per month and 203(24.4%) earned greater than1701 Birr ($83) family income per month, with the mean income was 1233.88 Birr (SD±948.97 Birr) and the mode was 600 Birr ($29)(Table 1).

Sexual behavior and substance use among married women

Among the participants, 650 (78.1%) women were in monogamous union or relationship. They were

Table 1:-Socio-demographic characteristics of participants, Debre Tabor town, 2015 (n=832)

Characteristics	Number	Percent (%)
Age (years)		
≤24	100	12.0
25-34	301	36.2
35-44	199	23.9
45-54	134	16.1
≥55	98	11.8
Mean(SD) =37.64 (±12.75)		
Previous place of residence		
Rural	262	31.5
Urban	570	68.5
Religion		
Christians	695	83.5
Muslims	137	16.5
Ethnicity		
Amhara	788	94.7
Oromo	15	1.8
Tigrie	29	3.5
Educational status		
No formal education	438	52.6
Primary education	246	29.6
Secondary education	119	14.3
Higher education	29	3.5
Employment status		
Un employed	555	66.7
Employed	277	33.3
Family income per month		
≤560 Birr($27)	215	25.8
561-900($27.3-$44)	207	24.9
901-1700($44-$83)	207	24.9
≥1701($83)	203	24.4
Mode=600 Birr($29) Mean (D)=1233.88 Birr(± 948.97 Birr) ($60 + $46)		

At the time of data collection the exchange rate of 1 USD is 20.54 Eth.Birr

also asked for the duration of the relationship with their current husband and 340 (40.9%) of them reported less than five years, 196 (23.6%) reported six to ten years, 113(13.6%) of them reported 11-15 years and 183(22.0%) reported ≥16 years. The mean age at a time of first marriage was 18.4± 3.52 years and 474(57%) had<5 years and 205(24.6%) had e"5 years age difference with their current husband. Out of the study participants, 258 (31%) had first sexual intercourse without their willingness and 229(27.5%) offered sex for monetary gains or business purpose. Concerning substance use, 360(43.3%) and 171 (20.6%) of them reported that they had drunk alcohol and chewed Khat respectively (Table 2).

Table 2:-Characteristics of sexual behaviour and substance use among married women, Debre Tabor town, 2015 (n=832)

Characteristics	Number	(%)
Types of marriage		
Monogamy	650	78.1
Polygamy	182	21.9
Duration of relationship with current husband (years)		
≤5	340	40.9
6-10	196	23.6
11-15	113	13.6
≥16	183	22.0
Mean(SD) =(10.18 ± 8.57 years)		
Age difference with current husband (years)		
Equal	153	18.4
< 5	474	57.0
≥5	205	24.6
Age at first time of marriage (years)		
≤14	99	11.9
15-17	222	26.7
≥18	511	61.4
Mean(SD) =(18.37± 3.52 years)		
Willingness to having first sexual intercourse		
Yes	574	69.0
No	258	31.0
Offered sexual intercourse for monetary gains or business purpose		
Yes	229	27.5
No	603	72.5
Alcohol intake		
Yes	360	43.3
No	472	56.7
Khat chewing		
Yes	171	20.6
No	661	79.4

Prevalence and forms of gender-based violence

Over all from all study participants, 620(74.5%), (95%CI: 71.5%-77.3%) of the women had experienced at least one type of gender-based violence in life time and 348 (41.8%), (95%CI: 38.3%-45.1%) in the last 12 months. Among respondents, 86(10.3%) of married women experienced only psychological violence in life time and 61(7.3%) in the last 12 months, 30(3.6%) of married women experienced only physical violence in life and 21(2.5%) in the last 12 months,17(2%) experienced only sexual violence in life time and 12(1.4%) in the last 12 months. Two hundred and forty five (29.4%) of them reported they experienced both psychological and physical types of violence in life time and 112

Table 3:- Frequency of each experience of violence of participants, Debre Tabor town, 2015 (n=832)

Characteristics	Life time		Last 12 months	
	Yes n (%)	No n (%)	Yes n (%)	No n (%)
Psychological violence	518(62.3)	314(37.7)	296(35.6)	536(64.4)
-Insulted you or made you feel bad about yourself	473(56.9)	359(43.1)	211(25.4)	621(74.6)
-Belittled or humiliated you in front of other people	181(21.8)	651(78.2)	75(9)	757(91)
-Done things to scare or intimidate you on purpose (e.g. by the way he looked at you, by yelling and Smashing things)	346(41.6)	486(58.4)	154(18.5)	678(81.5)
-Threatened when asking your friends/family	198(23.8)	634(76.2)	113(13.6)	719(86.4)
-Threatened to hurt you or someone you care about	208(25)	624(75)	93(11.2)	739(88.8)
Physical violence	467(56.1)	365(43.9)	232(27.9)	600(72.1)
-Slapped you or thrown something at you that could hurt you, pushed you or shoved you or pulled your hair, kicked you, dragged you or beaten you up	431(51.8)	401(48.2)	193(23.2)	639(76.8)
- Hit you with his fist or with something else that could hurt you	229(27.5)	603(72.5)	63(7.6)	769(92.4)
-Choked or burnt you on purpose	29(3.5)	803(96.5)	12(1.4)	820(98.6)
-Threatened to use or actually used a gun, knife or other weapon against you	30(3.6)	802(96.4)	13(1.6)	819(98.4)
Sexual Violence	255(30.6)	577(69.4)	129(15.5)	703(84.5)
-Forced sex without you will.	96(11.5)	736(88.5)	24(2.9)	808(97.1)
-Had sexual intercourse that you did not want to because you were afraid of what your husband might do.	65(7.8)	767(92.2)	22(2.6)	810(97.4)
-Had unwanted sex position	54(6.5)	778(93.5)	24(2.9)	808(97.1)
-Had unwanted warm up for sex	180(21.6)	652(78.4)	80(9.6)	752(90.4)

(13.5%) in the last 12 months; 38(4.6%) of them reported they experienced both psychological and sexual types of violence in life time and 27(3.2%) in the last 12 months, 55(6.6%) of them reported they experienced both physical and sexual violence in life time and 30(3.6%) in the last 12 months and 148 (17.8%) experienced all types of violence in their life time and 49(4.9%) in the last 12 months.

Psychological violence

From all study participants, 518(62.3%) (95%CI: 58.7% - 65.5%) of the women had experienced at least one type of psychological violence during their life time and 296(35.6%) (95% CI: 32.3%-38.7%) had experienced at least one type of psychological violence in the last 12 months. In the last 12 months, 211(25.4%) women were insulted or made to feel bad about themselves,75(9%) women were humiliated in front of other people, 154(18.5%) women were intimidated on purpose and 113(13.6%) threatened when asking your friends or family and 93(11.2%)women were threatened to hurt them or someone they cared about (Table3).

Physical violence

From all study participants, 467 (56.1%) (95%CI: 52.7%-59.5%) of married women had experienced at least one type of physical violence during their life time and 232 (27.9%) (95%CI: 24.9%-30.9%) had experienced at least one type of physical violence in the last 12 months. In the last 12 months, 193 (23.2 %) women were slapped, 63 (7.6%) women hit with fist or something else, 12 (1.4%) choked or burnt on purpose and 13 (1.6%) threatened even using knife or gun (Table 3).

Sexual violence

From all study participants, 255(30.6%) (95%CI: 27.5%-33.8%) had experienced at least one type of sexual violence during their life time and 129(15.5%) (95%CI: 13.1%-7.9%) had experienced at least one type of sexual violence in the last 12 months. In the last 12 months preceding the study 129(15.5%) were physically forced to have sexual intercourse when they did not want, 22(2.6%) women had sexual intercourse without their interest because of fear of their partners action, 24(2.9%) women had sexual

Table 4:-Binary logistic regression output of factors associated with experience of at least one type of GBV among married women , Debre Tabor town, 2015(n=832)

Variables	GBV in life time Yes n (%)	No n (%)	COR (95%CI)	AOR (95%CI)	GBVin the last 12 months Yes n (%)	Non (%)	COR(95%CI)	AOR (95%CI)
Age (years)								
≤24	71(11.5)	29(13.7)	1	1	54(15.5)	46(9.5)	1	1
25-34	205(33.1)	96(45.3)	0.87(0.53-1.43)	1.53(0.84-2.81)	137(39.4)	164(33.9)	0.71(0.45-1.12)	1.10(0.64-1.91)
35-44	160(25.8)	39(18.4)	1.68(0.96-2.92)	4.51(2.12-9.60)**	88(25.3)	111(22.9)	0.67(0.42-1.09)	1.31(1.04-2.49) *
45-54	101(16.3)	33(15.6)	1.25(0.70-2.24)	3.76(1.64-8.61)**	37(10.6)	97(20.0)	0.33(0.19-0.56)**	0.95(0.45-2.00)
≥55	83(13.4)	15(7.1)	2.26(1.12-4.55)*	5.97(2.3015.51)**	32(9.2)	66(13.6)	0.41(0.23-0.74)**	1.10(0.49-2.45)
Previous place of residence								
Rural	184 (29.7)	78 (36.8)	1	1	85(24.4)	177(36.6)	1	1
Urban	436(70.3)	34(63.2)	1.38(0.99-1.92)	1.06(0.72-1.54)	263(75.6)	307(63.4)	1.78(1.31-2.42)**	1.16(0.81-1.67)
Educational status								
No formal edu.	328(52.9)	110(51.9)	1.57(0.71-3.48)	1.99(0.76-5.23)	166(47.7)	272(56.2)	0.75(0.35-1.60)	1.84(0.77-4.37)
Primary edu.	186(30.0)	60(28.3)	1.63(0.72-3.70)	2.19(0.83-5.79)	108(31.0)	138(28.5)	0.96(0.44-2.09)	1.88(0.78-4.51)
Secondary edu.	87(14.0)	32(15.1)	1.43(0.60-3.40)	1.63(0.59-4.50)	61(17.5)	58(12.0)	1.29(0.57-2.92)	2.06(0.82-5.17)
Higher edu.	19(3.1)	10 (4.7)	1	1	13(3.7)	16(3.3)	1	1
Employment status								
Unemployed	415(66.9)	140(66.0)	1.04(0.75-1.45)	1.17(0.79-1.73)	228(65.5)	327(67.6)	0.91(0.68-1.22)	1.20(0.85-1.71)
Employed	205(33.1)	72(34.0)	1	1	120(34.5)	157(32.4)	1	1
Family income per month in Eth.Birr								
≤™560	165(26.6)	50(23.6)	1	1	72(20.7)	143(29.5)	1	1
561-900	149(24.0)	58(27.4)	0.78(0.50-1.21)	0.98(0.60-1.61)	72(20.7)	135(27.9)	1.06(0.71-1.58)	1.12(0.71-1.77)
901-1700	156(25.2)	51(24.1)	0.93(0.59-1.45)	0.97(0.58-1.64)	95(27.3)	112(23.1)	1.69(1.14-2.50)**	1.30(0.82-2.07)
≥™1701	150(24.2)	53(25.0)	0.86(0.55-1.34)	0.61(0.35-1.05)	109(31.3)	94(19.4)	2.30(1.55-3.42)**	1.65(0.99-2.65)
Types of marriage								
Monogamy	475(76.6)	175(82.5)	1	1	260(74.7)	390(80.6)	1	1
Multiple union	145(23.4)	37(17.5)	1.44(0.97,2.16)	1.57(1.01-2.45) *	88(25.3)	94(19.4)	1.40(1.01-1.95) *	1.34(1.03-1.95) *

Table 4:-Binary logistic regression output of factors associated with experience of at least one type of GBV among married women , Debre Tabor town, 2015(n=832) (*Continued*)

Duration of relationship with current husband(Years)								
≤5	228(36.8)	112(52.8)	0.50(0.33-0.77)*	1.90(0.97-3.74)	125(35.9)	215(44.4)	1.08(0.74-1.57)	1.94(1.05-3.57) *
6-10	161(26.0)	35(16.5)	1.13(0.67-1.89)	1.90(0.96-3.74)	114(32.8)	82(16.9)	2.58(1.71-3.92)**	3.27(1.81-5.9)**
11-15	84(13.5)	29(13.7)	0.71(0.41-1.24)	0.92(0.47-1.80)	45(12.9)	68(14.0)	1.23(0.76-2.00)	1.64(0.88-3.01)
≥16	147(23.7)	36(17.0)	1	1	64(18.4)	119(24.6)	1	1
Age difference with current husband								
Equal	92(14.8)	61(28.8)	1	1	58(16.7)	95(19.6)	1	1
<5	341(55.0)	133(62.7)	1.70(1.16-249)**	1.27(0.83-1.95)	149(42.8)	325(67.1)	0.75(0.51-1.10)	0.65(0.42-1.03)
≥5	187(30.2)	18(8.5)	6.89(3.85-12.3)*	3.57(1.83-6.97)**	141(40.5)	64(13.2)	3.61(2.32-5.61)**	1.24(0.73-2.10)
Age at first time of marriage								
≤14	73(11.8)	26(12.3)	1.25(0.77-2.02)	1.34(0.76-2.35)	22(6.3)	77(15.9)	0.44(0.26-0.73)	1.03(0.58-1.83)
15-17	193(31.1)	29(13.7)	2.95(1.914.55)**	2.66(1.65-4.28)**	124(35.6)	98(20.2)	1.94(1.41-2.66)**	1.89(1.3-2.75)**
≥18	354(57.1)	157(74.1	1	1	202(58.0)	309(63.8)	1	1
Willing to first sex								
Yes	432(69.7)	142(67)	1	1	240(69.0)	334(69.00	1	1
No	188(30.3)	70(33.0)	0.89(0.63-1.23)	0.93(0.64-1.34)	108(31.0)	150(31.0)	1.00(0.74-1.35)	1.24(0.88-1.75)
Offered sexual intercourse for monetary gains or business purpose								
Yes	187(30.2)	42(19.8)	1.75(1.202.55)**	1.58(1.03-2.41)*	114(32.8)	115(23.8)	1.56(1.15-2.12)**	1.07(0.75-1.52)
No	433(69.8)	170(80.2)	1	1	234(67.2)	369(76.2)	1	1
Alcohol intake								
Yes	318(51.3)	42(19.8)	4.26(2.946.19)**	3.54(2.21-5.67)**	229(65.8)	131(27.1)	5.18(3.85-6.99)**	4.4(2.94-6.58)**
No	302(48.7)	170(80.2)	1	1	119(34.2)	353(72.9)	1	1
Khat chewing								
Yes	136(21.9)	35(16.5)	1.42(0.94-2.14)	1.15(0.73-1.81)	80(23.0)	91(18.8)	1.29(0.92-1.81)	1.12(0.76-1.65)
No	484(78.1)	177(83.5)	1	1	268(77.0)	393(81.2)	1	1

1=Reference * P <0.05 ** P<0.01

intercourse with unwanted sex position and 80(9.6%) women were forced to unwillingly warm up for sex which they found degrading or humiliating (Table 3).

Overlap between psychological, physical and/or sexual violence

From all study participants, 86(10.3%) of married women experience psychological violence only in life time and 61(7.3%) in the last 12 months, 30(3.6%) of married women experienced physical violence only in life and 21(2.5%) in the last 12 months, 17(2%) experienced sexual violence only in life time and 12(1.4%) in the last 12 months. Two hundred and forty five (29.4%) of them reported they experienced both psychological and physical types of violence in life time and 112 (13.5%) in the last 12 months, 38 (4.6%) of them reported they experienced both psychological and sexual types of violence in life time and 27(3.2%) in the last 12 months, 55(6.6%) of them reported they experienced both physical and sexual violence in life time and 30(3.6%) in the last 12 months and 148 (17.8%) experience all types of violence in their life time and 49(4.9%) in the last 12 months.

Factors associated with gender-based violence

In the final model, a number of socio-demographic, substance use and behavioural factors were identified as significant predictors of life time and current experiences of GBV. Age, types of marriage, age difference with current husband, age at a time of first marriage, had sex for business purpose and alcohol intake were significantly associated with overall gender based violence at 5% level of significance.

Women in the age group of 35-44 years 4.5times in life time (AOR=4.51,95%CI:2.12-9.60),1.3times in the last 12 months (AOR =1.31,95%CI:1.04-2.49), those in age group 45-54 years 3.8 times in life time(AOR =3.76,95%CI :1.64-8.61)and those in age group ≥55 years 6 times in life time (AOR =5.97,95%CI:2.30-15.51) were more likely to experience GBV than compared to those who have age group less than 24 years.

Participants with polygamy marriage type 1.6 times (AOR=1.57, 95%CI: 1.01-2.45) in life time and 1.3 times (AOR =1.34, 95%CI: 1.03-2.65) in the last 12 months were more likely to experience GBV than as compared to those who have monogamy marriage type.

Women who had stayed in relationship or union with current husband for less than 5years was 2times (AOR =1.94, 95%CI: 1.05-3.57) and 6-10 years was 3 times (AOR =3.27, 95%CI: 1.81-5.90) more likely to experience GBV in the last 12 months compared to women ≥16 years in relationship with current husband.

Women in age difference with their current husband of greater than 5years were 4 times in life time (AOR=3.57, 95% CI: 1.83-6.97), more likely to experience GBV than compared to those who have equal age with their husband. Women's age group 15-17 years at first marriage were2.7 times (AOR=2.66,95% CI:1.65-4.28) in lifetime and 1.9 times (AOR=1.89,95%CI:1.30-2.75), in the last 12 months more likely to experience GBV as compared to those of age group ≥18 years at first marriage. Participants who offered sexual intercourse for monetary gains or business purpose were 1.6 times in life time(AOR=1.58, 95%CI: 1.03-2.41), more likely to experience GBV than compared to those did not offer sexual intercourse for monetary gains or business purpose. Women drank alcohol 3.5 times in life time (AOR=3.54, 95%CI: 2.21-5.67) and 4.4 times in the last 12 months (AOR=4.40, 95% CI: 2.94-6.58) were more likely to experience GBV compared to those not taking alcohol.

The observed association found between potential contributing factors of duration in relationship in marriage or in union with GBV in life time, previous place of residence and family income with GBV in the last 12 months during bivariate analysis were refuted after adjusting for the above factors (Table 4).

Discussion

In this study the results show that the life time prevalence of at least one type of gender-based violence (psychological violence, physical violence, and/or sexual violence) was 74.5 % and in the last 12 months was 41.8%, which reflects high prevalence. This finding was consistent from cross-sectional studies done in Ethiopia in Guragie zone, Southwest Ethiopia, and Wollegea zone, West Ethiopia which showed the life time prevalence of GBV among married women was 72% and 76.5% respectively [13, 14], and higher compared from a study conducted in Jimma, Southwest Ethiopia and Gondar, Northwest Ethiopia which showed the prevalence of GBV was 64.7% and 50.8 % respectively [15, 17]. This could partly be due to cultural discrepancy.

This finding was higher than that of a systematic review conducted from different African countries between 1990-1992, which indicated the prevalence of GBV in Uganda (46%), Kenya (42%), Tanzania (60%), and Zambia (40%), among women

who had experienced at least one type of GBV in their life time [26]. The finding is higher than those of studies conducted from different countries. For instance, the life time prevalence of GBV in Italy (10.2%) [6], Cambodia (60%), India (30%), USA (28%), Columbia (19%) [7] and Vietnam (29.1%) **[**9**]**. Thus differences in prevalence may be socio-demographic and socio-cultural differences of the study populations. .

There is no substantial overlap between psychological and sexual violence for women who experienced GBV in lifetime (4.6%) and in last 12 months (3.2%), physical and sexual violence for women who experienced GBV in lifetime was 6.6% and in last 12 months 3.6%. Again, of all abused women, 2.0% reported the experience of isolated sexual violence in their lifetime and 1.4% in the last 12 months. This suggests that forced sexual acts alone by their partner were not as prevalent in this population compared with isolated sexual violence by an intimate partner reported for other developing countries of WHO multi-county study on violence against women that showed 31% in Butajira [27] and 33% in Bangladesh [22]. The possible explanation is that women are less inclined to disclose sexual violence because it is shameful and very sensitive topic to be more pronounced in poor socio-economic country including Ethiopia.

Older age of the respondents was significantly associated with nearly six times more likely increased risk of lifetime GBV, and younger age group of the respondents was significantly associated with two fold increased risk of current gender-based violence. Similar finding was obtained from a study done in East Wolega, Western Ethiopia where older women were nearly four times more likely to report the incidence of GBV [14] and in Bangladeshi women older than 20 years were more likely to experience GBV and sexual violence [24].This may be because women who are older and in marriage are more likely to have experienced GBV from their husband and women who are young and in marriage are more likely to be physically and psychologically violated by their husband. However, this is not consistent with Fernandez's idea who described that "as the age of woman increases she often grows in social status as she becomes not only a wife, but also a mother and a socially influential member of her community". Thus older women are less likely to report current experience of GBV than younger women.

Women who were married to polygamous husbands/partners, had nearly two times increase in the risk of lifetime and current experience of gender-based violence. This is consistent with the study done in East Wollga, West Ethiopia [14], China and Uganda [19,20]. It was reported that having multiple sexual partners could put women at increased risk for GBV with violence which results in psychological burden, low self esteem, feelings of embarrassment and humiliation [18].

The duration of relationship or union with current husband was significantly associated with experiences of GBV. Women who had been with their current husband for less than 10 years were three times more likely have suffered GBV when compared to those who have been in relationship or union for more than 16 years. It might be that married women with short duration of relationship or in union cannot easily understand to each other, or have free communication to solve the problem and poor ability to solve the problem, which could increase vulnerability of conflict and violence. In addition to duration of relationship as their maturity also increases the risk of GBV decreases.

On the other hand, women's age difference with their current husband was significantly associated with risk of GBV. Participants who have current husband's age greater than 5 years than her age were four times more likely to experienced risks of life time GBV when compared to those who had equal ages with their husband. It is supported by a study conducted in New York which showed that adolescent girls with older male partners are at greater risk for adverse sexual health outcomes than other adolescent girls [28]. It indicates that low relationship power occurs with husband age difference, and the effect of husband age difference between an adolescent girl and her male partner on sexual risk behaviour through the mediators of sexual relationship power and GBV severity.

Early marriage increases the likelihood of experiencing GBV. Women's age at first marriage between 15-17 years was three times more likely to increase the risk of life time GBV and two times the risk of current GBV than compared to those whose ages at first marriage was $\geq$18 years. This is consistent with the finding of a study from several countries, which a young age at first marriage is related to women's experience of violence [21]. In Bangladesh, most of the girls are married-off at their teen ages. Their ability to take decision as young wives is usually poor. As such they are more victimized than those married at adult ages [22]. Early marriage acts as a barrier to several girls obtaining basic education as they abandon the pursuit of education and start early to rear children immediately they enter into a husband's house. This

position even offends the real purpose of the MDG 3.Indeed child marriage is a fundamental violation of human rights and a gender-based violence; especially as these young girls are married out to older men without their free and full consent. More of international best practices and conventions dictate 18 years as the legal age of consent to marriage. It may be that couples in early marital union are faced with teething problems of early marriage which they would not solve through free inter frontal communication, understanding each other and tolerance. Thus their ability to overcome their marital challenges without violence is poor.

Women who offered sexual intercourse for monetary gains or business purpose were two times more likely to experience increased risk of gender-based violence in life time. This finding is consistent with a study done in Canada within sex workers and gender-based violence [29]. It might be that commercial sex workers are uninterested in intimate relationship and tend to fight with their partners; in addition women in this group take alcohol and substances which predispose to GBV.

On the other hand, women who drank alcohol were at four times increased risk of life time and current experiences of GBV. This finding was similar to a study conducted in Shimbela, North Ethiopia which showed that partners who drank alcohol had two folds risk of GBV [16]. This could be attributed for heavy consumption of alcohol which tends to reduce inhibitions, clouds judgment, and impairs ability to interpret social cues and hinder women from protecting themselves from violence [30].

As to the limitation of this study, the cross-sectional nature could cause difficulty of determining the direction of the association between study variables. The associations could only be discussed in terms of plausibility. A further limitation is that the research team interviewed only women as proxy respondents for their husbands and hence relie on women's reports only. This can be biased when it comes to reporting on husbands' characteristic. This study did not include homeless and street married women, this marginalized group may have different characteristics of gender-based violence experience. On the other hand the strengths of this study were, it has a community-based nature and the respondents had been selected by random sampling technique with relatively large sample size, used a standard and validated instrument of WHO multi-country study on VAW including special training of interviewers designed to maximize disclosure of violence across different social and cultural groups [31].

Conclusion and recommendation

High prevalence of gender-based violence has been reported in the study area. Compared to similar studies, the finding is among the highest. The study noted that three quarters, of married women experienced at least one type of gender-based violence (psychological violence, physical violence, and/ or sexual violence) in their lifetime. Factors such as age, types of marriage, duration of relationship or in union, age difference with current husband, age at a time of first marriage, offered sexual intercourse for monetary gain or business purpose and alcohol intake were significantly associated with the risks of gender-based violence.

Intervention strategies such as public enlightenment on the effects of gender based violence on both women and men in all relationships, programs about gender-based violence to enhance gender equality, government needs to address gender-based violence by promulgating appropriate laws and punishment in the community. Expanding and strengthening of information, education, communication and behavioural change activities aimed at preventing gender-based violence in the community should be carried out. In addition, pre-marital counselling and conflict resolution strategies especially among couples should be strongly intensified to improve the situation.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

AAM conceptualized the research problem, prepared the proposal, designed and conducted the study ,participated in data collection, did the statistical analysis, interpretation of the findings, prepared the manuscript and rewrote the manuscript based on input from the co-author. **AOA** and **AOA** revised the proposal and participated in the manuscript writing. The authors read and approved the final content of the manuscript.

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Derivation and appraisal of maternal mortality estimates in Nigeria from the 2012 National HIV/AIDS and Reproductive Health Survey

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Abstract

Background: Despite the huge burden of in Nigeria, accurate and reliable data for maternal mortality measurement are lacking. The Federal Ministry of Health in collaboration with development partners included questions that allow indirect estimation of maternal mortality in its 2012 National HIV/AIDS and Reproductive Health Survey (NARHS). The aim of this paper was to derive estimates of Maternal Mortality Ratio (MMR) and Lifetime Risk of maternal death (LTR) from the 2012 NARHS data.

Methods: This was a secondary analysis of data from the maternal mortality module of NARHS 2012. During the survey, respondents (men aged 15-59 years and women aged 15-49 years) were selected via a multi-stage cluster sampling technique and data collected by trained field workers. In this study, report on survival or otherwise of adult female siblings were analysed to derive estimates of life time risk of maternal death using the indirect sisterhood method.

Results: Data from 15, 596 men and 15, 639 women were analysed. A total of 12,810 adult female siblings had been exposed to the risk of death out of which 377 (2.9%) have died. Of the 377 adult female deaths, 70 (18.6%) were pregnancy-related. The estimates of LTR and MMR were 1 in 71 women and 256 (95% CI: 196 – 316) maternal deaths per 100,000 livebirths respectively. There were north-south and rural-urban differences.

Conclusion: The high level of maternal mortality is worrisome, concerted efforts aimed at reduction and provision of routine data for its measurement should be intensified.

Keywords: *National HIV/AIDS and Reproductive Health Survey, Maternal mortality, Sisterhood method, Nigeria*

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Résumé

Contexte: Malgré l'énorme fardeau au Nigeria, des données précises et fiables pour la mesure de la mortalité maternelle sont insuffisantes. Le ministère fédéral de la Santé, en collaboration avec les partenaires du développement, a inclus des questions qui permettent une estimation indirecte de la mortalité maternelle dans son Sondage Nationale sur le VIH / Sida et la Santé Reproductive (NARHS) de 2012. L'objectif de cet article était de tirer des estimations du Ratio de Mortalité Maternelle (RMM) et du Risque à Vie de mortalité maternelle (RV) à partir des données de NARHS 2012.

Méthodes: Il s'agissait d'une analyse secondaire des données du module de mortalité maternelle de NARHS 2012. Au cours du sondage, les répondants (hommes âgés de 15 à 59 ans et femmes âgés de 15 à 49 ans) ont été sélectionnés par une technique d'échantillonnage en groupe à plusieurs étapes et les données recueillis par des agents de terrain qualifiés. Dans cette étude, le rapport sur la survie ou autrement des sœurs adultes a été analysé afin de déterminer les estimations du risque à vie de mort maternelle en utilisant la méthode de la fraternité féminine indirecte.

Résultats: Les données provenant de 15.596 hommes et 15.639 femmes ont été analysées. Un total de 12.810 sœurs adultes avait été exposé au risque de décès, dont 377 (2,9%) sont décédés. Des 377 décès de femmes adultes, 70 (18,6%) étaient liés à la grossesse. Les estimations de RV et RMM étaient de 1 femme sur 71 et 256 (95% IC: 196 - 316) de décès maternels pour 100.000 naissances vivantes respectivement. Il y avait des différences nord-sud et rurales-urbaines.

Conclusion: Le taux élevé de mortalité maternelle est inquiétant, des efforts concertés visant à réduire et à fournir des données de routine pour sa mesure devraient être intensifiés.

Mots-clés: *Sondage Nationale sur le VIH / Sida et la Santé Reproductive, Mortalité maternelle, méthode de la fraternité féminine, Nigéria*

Introduction

In the last two decades, international efforts such as the safe motherhood initiative, International Conference on Population and Development,

Millenium Development Goals (MDG) and several other initiatives have concentrated on the improvement of maternal and child health. India (19%) and Nigeria (14%) accounted for a third of global maternal deaths with an estimated risk of 1 in 31 women dying of pregnancy-related complications in Nigeria [1]. Thus, reduction of maternal mortality remains a top priority in the health development agenda for Nigeria and many other developing countries. However, the dearth of relevant, accurate, complete and reliable data has been the bane in the calculation of accurate mortality levels in Nigeria.
An accurate estimation of the magnitude of maternal death is the first step towards reducing maternal morbidity and mortality [2]. The appropriate and most reliable data source for producing mortality estimates is a vital statistics registration system (VRS) with death certification. The lack of good quality vital resgistration system in most developing countries and indeed in Nigeria constitute a major impediment to accurate measurement of maternal mortality [1, 3, 4].

Due to poorly developed VRS, maternal mortality estimates in Nigeria could be attributed to three main alternative sources. The first and the most common estimates are those from health facility statistics/studies. These do not require special collection strategies and provide data on cause(s) of death. The limitations are obvious- they capture facility deaths only and thus may not adequately represent the population. Given the poor utilization of maternal care services in Nigeria, maternal deaths could have occurred outside the health facilities without being captured in facility records. Secondly, most facility-based studies that provided maternal mortality estimates were conducted in tertiary facilities which provide specialist/referral services [5-7]. Thus, there is likelihood that these figures are based on patients with higher obstetric risks than what obtains in the general population. Further evidence in support of this is the fact that more than 50% of maternal deaths occur among unbooked patients [5-9]. This selection bias may be one of the reasons for very high MMR reported in many of these facility-based studies.

The second source are those derived from statistical models by international agencies such as WHO and UNICEF. Such have been produced for 1990, 1995, 2000, 2005, 2008, 2010 and 2013. Maternal mortality ratio in Nigeria have ranged from 1200 in 1990 to 560 in 2013 [1]. Based on this, the country had an average annual decline of 3.1% between 1990 and 2013 and thus rated as making progresss but not on target to acheive MDG 5 [1]. Though, the models have been improved over the years, however, sub-national estimates have never been produced.

The third source of maternal mortality estimates in Nigeria are population-based surveys. Multiple Indicator Cluster Survey (MICS) and Nigeria Demographic and Health Survey (NDHS) are the only examples in this category. It is notable that most MICS conducted in Nigeria have rarely reported maternal mortality estimates even when requisite data have been collected. This is due to poor quality of data required for estimation- the commonest data quality problem being omission or under-reporting of births and deaths [10-12]. In 2008, the NDHS included a maternal mortality module for the first time in its eighteen year history. A MMR of 545 per 100,000 live births was estimated using the direct sisterhood method [13]. Government and several agencies were excited about this sharp decline from the 1100 model-based estimate for 2005. NDHS 2013 report showed that MMR for seven years preceding the survey is 576 with a comment that there was not much difference from the 2008 estimate [14]. There have been very few local household surveys in which the indirect sisterhood method has been employed to estimate MMR. The evidence from these studies however, varied widely from 450 in Lagos [15], 6525 in Ibadan [16] and 1400 in Kaduna [17].

The Federal Ministry of Health in collaboration with some international partners has conducted the National HIV/AIDS and Reproductive Health Survey (NARHS) since 2003. The survey has been repeated in 2005, 2007 and 2012. The main objective was to provide updated information on sexual and reproductive health in Nigeria as well as the factors influencing them [18]. In an effort to contribute to the empirical evidence on maternal mortality in Nigeria, a maternal mortality module similar to that in the NDHS was introduced in the 2012 round of NARHS. In this paper, we analysed the 2012 NARHS data to derive the MMR and lifetime risk of maternal death in Nigeria. We also provide estimates for the north, south regions, rural and urban settings. A critical appraisal of some of the factors that affect the accuracy and consistency of maternal mortality estimates in Nigeria was also undertaken.

Materials and method

The 2012 National HIV/AIDS and Reproductive Health and Serological Survey (NARHS Plus) was a cross-sectional study covering men and women of reproductive age. It involved a nationally representative sample of females aged 15-49 years and males aged 15-64 years living in households in rural and urban areas in Nigeria in all the 36 states and the Federal Capital Territory (FCT).

Multi-stage cluster sampling was used to select eligible persons. Stage 1 involved the selection of one rural and urban local government area (LGA) from each state and the FCT. Stage 2 involved the selection of Enumeration Areas (EA) within the selected rural and urban LGAs. Stage 3 involved the listing and selection of households while stage 4 involved selection of individual respondents for interview. Thirty- two individuals were sampled from each of the 30 sampled EA (clusters) from each state. Overall, 35,520 individual respondents were selected for final interview of which 31,235 individuals (88%) were successfully interviewed. The data was weighted to reflect differences in population sizes of the states.

Maternal mortality module in the NARHS 2012 questionnaire

The maternal mortality section of the questionnaire consisted of basic sibling survivorship questions such as: how many children did your mother give birth to, including you. For each sibling, respondents were asked about the name, gender, current age (if alive) and age at death (if dead). For every female sibling who was dead, questions were asked about circumstances surrounding death – whether pregnant; during childbirth; or within two months after a pregnancy/childbirth.

Estimation procedure

An indirect demographic estimation technique, the sisterhood method, was applied to obtain the life time risk of maternal death [19]. The method uses the proportions of adult female siblings (sisters) dead from pregnancy-related causes reported during a single round demographic survey to derive estimates of life-time risk of maternal death as follows:

Life-time risk of maternal death (LTR)

Numerator: number of female siblings of respondents who died during pregnancy, delivery or within two months of delivery by five–year age group of respondent.

Denominator: number of years of sister-units of exposure of female siblings of respondents by five-year age group of respondent.

Sisters-units of exposure was calculated by applying an adjustment factor to the number of sisters who were exposed to pregnancy risk. Sisters exposed to pregnancy risk are female siblings who were alive and aged at least 15 years or females who died at age 12 years and above from pregnancy-related causes.

The total life time risk of maternal mortality was obtained by the quotient of the sums of the age specific numerators and denominators.

Table 1: Socio-demographic characteristics of respondents, NARHS 2012, Nigeria

Variable	Male n(%)	Female n(%)
Age group		
15 - 19	2473 (15.9)	2770 (17.7)
20 - 24	2035 (13.0)	2813 (18.0)
25 - 29	2098 (13.5)	2902 (18.6)
30 - 34	1987 (12.7)	2349 (15.0)
35 - 39	1696 (10.9)	1761 (11.3)
40 - 44	1533 (9.8)	1561 (10.0)
45 - 49	1143 (7.3)	1483 (9.5)
50 - 54	1101 (7.1)	-
55+	1530 (9.8)	-
Residence		
Rural	10724 (68.8)	10733 (68.6)
Urban	4872 (31.2)	4906 (31.4)
Education		
No formal education	2810 (18.1)	4846 (31.0)
Quranic only	1358 (8.7)	900 (5.8)
Primary	2644 (17.0)	2620 (16.8)
Secondary	6403 (41.1)	5769 (36.9)
Higher	2349 (15.1)	1486 (9.5)
Marital status		
Married/Co-habiting	9229 (59.6)	10714 (69.1)
Never married	5774 (37.3)	3850 (24.8)
Separated/divorced	222 (1.4)	377 (2.4)
Widowed	147 (0.9)	499 (3.2)
No response	109 (0.7)	59 (0.4)
Region		
North Central	3055 (19.6)	2953 (18.9)
North East	2526 (16.2)	2349 (15.0)
North West	3116 (20.0)	3036 (19.4)
South East	2024 (13.0)	2258 (14.4)
South West	2468 (15.8)	2532 (16.2)
South South	2407 (15.4)	2511 (16.1)

Maternal mortality ratio (MMR)

This was calculated using the equation

$$MMR = 100{,}000 * [1 - [1 - LTR]^{(1/TFR)}]$$

TFR= total fertility rate

Though the LTR for the age groups could be utilised to investigate trends, the sample size was not sufficient for such investigation in this paper. Due to the very small number of cases of maternal deaths reported, it is preferrable to rely on the overall estimate of the life time risk of maternal mortality (using data for age group 15-49). The 95% confidence intervals (CI) for MMR was estimated using a procedure suggested by Hanley *et al* [20]. Standard errors, lower and upper confidence limits were obtained for LTR. These were then substituted into the MMR formular to obtain its lower and upper limits.

Results

The socio-demographic characteristics of the respondents are summarised in table 1. The sex distribution was balanced between male (49.9%) and

Table 2: Estimates of life-time risk of maternal death and maternal mortality ratio according to location, NARHS 2012, Nigeria

Population sub-group	Life-time risk of maternal death	Maternal Mortality Ratio (95% CI)*
Rural	0.0160 (1 in 63)	260 (190 – 330)
Urban	0.0101 (1 in 100)	215 (113 – 317)
North	0.0206 (1 in 49)	341 (251 – 432)
South	0.0067 (1 in 149)	150 (77 – 223)
Nigeria	0.0140 (1 in 71)	256 (196 - 316)

* per 100,000 live births

Table 3. Maternal mortality estimation for Rural and Urban Nigeria using the indirect sisterhood method, NARHS 2012.

	Age group of respondents (1)	No of respondents (2)	No of sisters exposed (3)	Adult female deaths (4)	Maternal deaths (5)	Adjustment factor (6)	Sist unit of risk exposure (7) = (3) x (6)	LTR 8) = (5)/ (7)
	15-19	1638	796	15	6	0.107	85	0.0704
	20-24	1537	736	19	2	0.206	152	0.0132
	25-29	1707	821	27	4	0.343	282	0.0142
	30-34	1524	638	18	0	0.503	321	0.0000
	35-39	1150	479	12	5	0.664	318	0.0157
	40-44	955	341	13	0	0.802	273	0.0000
	45-49	858	288	17	0	0.900	259	0.0000
	Total			121	17		1690	0.0101
Rural	15-19	2983	1716	16	1	0.107	184	0.005
	20-24	2674	1505	25	7	0.206	310	0.023
	25-29	2731	1505	56	13	0.343	516	0.025
	30-34	2322	1171	42	15	0.503	589	0.025
	35-39	1945	903	35	8	0.664	600	0.013
	40-44	1718	703	31	5	0.802	564	0.009
	45-49	1514	604	51	4	0.900	544	0.007
	Total			256	53		3306	0.0160
Overall	15-19	4553	2512	31	7	0.107	269	0.026
	20-24	4134	2241	44	9	0.206	462	0.019
	25-29	4369	2326	83	17	0.343	798	0.021
	30-34	3788	1809	60	15	0.503	910	0.016
	35-39	3064	1382	47	13	0.664	918	0.014
	40-44	2644	1044	44	5	0.802	837	0.006
	45-49	2341	892	68	4	0.900	803	0.005
	Total			377	70		4996	0.0140

LTR – Life time risk of maternal death

female (50.1%). A larger proportion were in age group 25-29 years (male – 13.5%, female-18.6%) while about one third were living in rural areas. More females (31.0%) than males (18.1%) had no formal education but overall, about half of males (56.2%) and females (47.4%) had at least a secondary education. Table 1 also shows that all the six geo-political zones (regions) are evenly represented in the sample with proportions ranging from 13.7% for South East to 19.7% for North West.

Maternal mortality estimates

A total of 12,810 adult female siblings had been exposed to the risk of death out of which 377 (2.9%) have died. Of the 377 adult female deaths, 70 (18.6%) were pregnancy-related. The distribution of adult female deaths and proportion of pregnancy-related deaths varied widely between the north (23.7%) and the south (10.7%) and between rural (20.7%) and urban (14.0%) settings.

Table 2 shows the estimates of life-time risk of maternal deaths and maternal mortality ratio according to location and region (North and South). In rural locations, 1 in every 63 women were estimated to be at risk of death during pregnancy, childbirth or the puerperium in the reproductive life time. This is higher than the estimate for urban locations where the risk was 1 in every 100 women.

The corresponding MMR were 260 (95% CI: 190 – 330) and 215 (95% CI: 113 – 317) maternal deaths per 100, 000 live births in the rural and urban locations respectively. In the Northern regions (North West, North East and North Central), the MMR was estimated as 341(95% CI: 251 – 432) maternal deaths per 100,000 live births compared to 150 (95% CI: 77 – 223) per 100,000 in the Southern regions of Nigeria. The overall MMR and LTR for the entire nation were estimated as 256 (95% CI: 196 – 316) per 100, 000 and 1 in 71 women respectively. Details of the computations are shown in tables 3 and 4.

Differences in base data

Data differences could arise if the questionnaire used for data collection has substantial variations. Therefore, the logical approach to systematically assess data differences is to compare the questionnaire module for collecting maternal mortality in the NARHS 2012 with that of the NDHS 2008 and 2013. It is observed that both NARHS 2012 and NDHS 2013 used sibling history approach in data collection. However, the questions in NARHS 2012 were slightly different and this could have contributed to differences in the estimates of MMR from NARHS 2012 and NDHS 2013. The first question in the NARHS 2012 maternal mortality module is : *"How many children did your mother give birth to including you?"*. If the respondent is the only child of his mother, the section is ended on that note but if there are two or more births, interviewers proceeded to complete the sibling history by asking the next question which was " *How many of these births did your mother have before you were born*?".

In the NDHS 2008/2013, after this question, interviewers proceeded to collect detailed sibling history where questions were asked about name, sex, current age of living sibling, age at death and years since death of dead siblings. Respondents were also asked whether death of female siblings occur in pregnancy, child birth or six weeks after pregnancy/ childbirth. Following the second question, NARHS

Table 4. Maternal mortality estimation for Northern and Southern Nigeria using the indirect sisterhood method

	Age group of respondents (1)	No of respondents (2)	No of sisters exposed (3)	Adult female deaths (4)	Maternal deaths (5)	Adjustment factor (6)	Sist unit of risk exposure (7) = (3) x (6)	LTR (8) = (5)/ (7)
North	15-19	1638	1187	18	2	0.107	127	0.0157
	20-24	1537	1200	20	8	0.206	247	0.0324
	25-29	1707	1265	56	16	0.343	434	0.0369
	30-34	1524	993	38	15	0.503	499	0.0300
	35-39	1150	736	30	8	0.664	489	0.0164
	40-44	955	555	28	3	0.802	445	0.0067
	45-49	858	418	38	2	0.900	376	0.0053
	Total			228	54		2618	0.0206
South	15-19	2983	1325	13	5	0.107	142	0.035
	20-24	2674	1041	24	1	0.206	214	0.005
	25-29	2731	1061	27	1	0.343	364	0.003
	30-34	2322	816	22	0	0.503	410	0.000
	35-39	1945	646	17	5	0.664	429	0.012
	40-44	1718	489	16	2	0.802	392	0.005
	45-49	1514	474	30	2	0.900	427	0.005
	Total			149	16		2378	0.0067

Discussion

The MMR of 256 per 100,000 live births obtained in this study is lower than estimates from the NDHS 2013 and WHO estimates for 2013 as well as other evidence from local community studies [15, 21, 22]. However, the LTR of 1 in 71 obtained in this study is lower than the 1 in 38 for Sub-Saharan Africa [1]. An important question for further consideration is: why is the NARHS 2012 estimates low compared to those from other national surveys such as NDHS 2008 (545 per 1000 livebirths) and 2013 (576 per 1000 livebirths)? The discrepancies could be due to : (i) differences in the base data; (ii) data quality or (iii) differences in method of estimation. Each of these reasons are briefly expantiated.

2012 had an additional instruction which the NDHS did not have. The instruction was that interviewers should *skip the sibling history questions if the respondent is oldest child.* The implication of this is that NARHS 2012 only collected sibling history data from respondents who were not the oldest children of their mother. In other words, first born respondents were excluded from data collection in the maternal mortality module. A further check on the frequency distribution of the number of preceding births as collected in the survey revealed that out of 27,077 respondents whose mothers had two or more births, 10, 252 (38%) were first births and subsequently exempted from reporting on the survival or otherwise of their siblings. This exclusion definitely reduced the number of siblings (brothers and sisters reported), the number exposed to the risk of death and ultimately, the number alive/dead. It is expected that first born respondents would have had more siblings. Therefore, excluding them must have resulted in omission/ under-reporting of births and deaths which eventually would cause any mortality estimate to be biased downward.

Data quality

Under-estimation of maternal mortality could also be as a result of data quality problems. We conducted some internal data quality checks on the NARHS 2012 sibling history data. For instance the sex ratio (male to female) of all siblings, living siblings and dead siblings were 1.24, 1.23 and 1.25 respectively. In Nigeria, evidence from NDHS shows that sex ratio among adult usually ranges between 0.97 and 1.02 [13, 14]. Based on this widely accepted demographic norm, female siblings were likely to have been under-reported. This could have resulted in under-estimation of MMR. Efforts should be made to overcome this weak points in future surveys in the country.

Diferences in method of estimation

The different methods of estimation ever used for maternal mortality in Nigeria have been summarised in the background section of this paper. Field experience from Nigeria and other countries showed that the direct and indirect method of estimating MMR from household survey data may yield different estimates[23, 24]. Adebowale *et al* (2011) computed an indirect estimate of MMR as 436; this was lower than the direct estimates in the NDHS 2008 report [25]. On the other hand, it appears there is convergence of evidence between maternal mortality estimates from NDHS 2008/2013 and those by WHO/UNICEF. This is premised on the closeness of NDHS 2013 MMR estimates (576) and model-based estimate of 560 from the WHO/UNICEF group[1]. The WHO model consisted of indicators such as general fertility rate (GFR), gross domestic product and proportion of births with skilled attendants at delivery. Evidence from 2013 NDHS showed that no improvement has been recorded in GFR and skilled attendants at delivery since 2003[14]. Same pattern was observed for antenatal care and other maternal and child health care services. This fact that not much success has been recorded in health systems improvement may be further credence to the near stagnation of maternal mortality at higher levels as shown by NDHS 2013 and 2008 estimates.

Suggestions for improving maternal mortality measurement in Nigeria

Maternal mortality estimates have been one of the most controversial health indicators in Nigeria. Any effort targeted at accurate measurement of mortality should be commended and supported by all stakeholders to provide plausible and incontrovertible estimates for Nigeria. One major lesson from NARHS 2012 maternal mortality estimated in this paper is the need to ensure that good quality data are collected. Collection of sibling history data is quite tasking given the level of literacy especially in the rural communities. Proper training and thorough monitoring of data collection processes can guarantee a better quality data in future surveys.Questionnaire modules that require special demographic techniques for analysis should be reviewed for correctness before field work.

Possible strategies to improve maternal mortality statistics in Nigeria [26] and other developing countries[4] have been suggested in the past. The first approach is to improve VRS. This is a long term strategy that requires necessary investment, strong political will, cooperation of all stakeholders such as National population Commission, National Bureau of Statistics, community leaders, religious leaders and others. Further practical steps for improving VRS in Nigeria are available from several sources[27, 28].

The second suggested strategy is to include questions on maternal deaths in the next population census scheduled for 2016. This could be followed up with verbal autopsy to ascertain the probable cause of death in the households. The next census provides a good opportunity for Nigeria as the extra cost of the additional questions would be very minimal compared to a dedicated survey on maternal mortality. Maternal mortality has been estimated

from censuses in Benin and Zimbabwe with very rich information provided[2, 29]. Nigeria could learn a lot from the experiences of these countries.

Another approach is the conduct of a nationwide maternal health survey with very large household size (range of 100,000 household). Such a large household sample survey would guarantee better precision and possibility of obtaining sub-national estimates which are seriously needed in Nigeria. The survey in Bangladesh[3, 30] is a good reference for this approach. The only challenge is the technical and financial resources that will be required but this should not be a limitation. The National Bureau of Statistics (NBS), National Population Commission(NPC), Federal Ministry of Health (FMoH) and international partners could pool resources together. Currently, NBS, NPC, FMoH - three government agencies conduct health-related surveys and all attempt to provide mortality estimates. These three can combine their resources and expertise to mount a big nationwide survey that can address their diverse data needs.

The fourth suggestion is continuation of facility-based studies. However, these should be improved upon to move it further from mere ocassional retrospective review of patients records for mortality to periodic audit inquiries to monitor quality of care and assess measures to reduce hospital mortality. It is also suggested that the culture of death certification be improved by re-training physicians and other health management information personnels on the correct use of International Classification of Disease codes.

Conclusion

Even though NARHS 2012 data may have under-estimated maternal mortality in Nigeria, the high level of maternal mortality is still worrisome considering the numerous intervention strategies by the government of Nigeria. Future surveys should design and implement field procedures that assure complete reporting of events and good data quality. The next population census should include questions to bridge the gap in maternal mortality estimation in Nigeria.

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Methanol extract of *Allium cepa Linn* ameliorate cyanide-induced biochemical alterations in the brain of Wistar rats.

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Abstract

Background: Cyanide has been reported to induce neurotoxicity by generating reactive oxygen species and reducing antioxidant enzymes. *Allium cepa Linn* increases the antioxidant status in animals. This study was designed to evaluate the effects of Methanol extract of *Allium cepa Linn* (onion) on the biochemical changes in the brain of male Wistar rats exposed to sub-acute doses of cyanide.
Methods: Thirty six male Wistar rats (180-200g) were divided into 6 groups (n=6). Group 1 was administered distilled water, groups 2, 3, 4, 5, and 6 were administered 600mg onion/kg /day, 7mg KCN/kg/day, 300mg onion/kg/day+ 7mgKCN/kg/day, 600mg onion/kg/day+ 7mg KCN/kg/day, 600mg $Na_2S_2O_3$/kg/day+ 7mg KCN/kg/day respectively for 2 weeks. Groups 4, 5 and 6 were pre-administered with 300mg onion/kg/day, 600mg onion/kg/day and 600mg $Na_2S_2O_3$/kg/day respectively for 2 weeks prior to co-administration with cyanide. Oxidative stress parameters were estimated in the brain.
Results: Malondialdehyde (MDA) level, Reduced Glutathione (GSH) level, Glutathione-S-Transferase (GST) and lactate dehydrogenase activity (LDH) in the brain of rats treated with cyanide were significantly higher ($p<0.05$) when compared with the control. This was accompanied by a significant decrease ($p<0.05$) in the antioxidant enzymes, Superoxide Dismutase (SOD) and Catalase. Co-administration with onion or $Na_2S_2O_3$ significantly reduced ($p<0.05$) the level of MDA, GST and LDH activity in the brain. There was a significant increases ($p<0.05$) in the activities of SOD, catalase and level of GSH in onion co-administered group when compared with the cyanide treated group.
Conclusion: The results suggest that onion extract may protect against cyanide-induced oxidative stress in the brain of male Wistar rats.

Keywords: *Onion, Sodium thiosulphate, Lipid peroxidation, Antioxidant, Cyanide, Oxidative Stress.*

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Résumé

Contexte: Le cyanure a été signalé à induit une neurotoxicité en générant des espèces réactives d'oxygène et en réduisant les enzymes antioxydants. Allium cepa Linn augmente le statut antioxydant chez les animaux. Cette étude a été conçue pour évaluer les effets de l'extrait de méthanol d'Allium cepa Linn (oignon) sur les changements biochimiques dans le cerveau des rats Wistar mâles exposés à des doses sous-aiguës de cyanure.
Méthodes: Trente-six rats Wistar mâles (180-200g) ont été divisés en 6 groupes (n = 6). Le groupe 1 a été administré à de l'eau distillée, le groupe 2, 3, 4, 5 et 6 ont été administrés 600 mg d'oignon / kg / jour, 7 mg de KCN / kg / jour, 300 mg d'oignon / kg / jour + 7 mg de KCN / kg / jour, 600 mg d'oignon / kg / Jour + 7mg KCN / kg / jour, 600mg $Na_2S_2O_3$ / kg / jour + 7mg KCN / kg / jour respectivement pendant 2 semaines. Les groupes 4, 5 et 6 ont été pré-administrés avec 300 mg d'oignon / kg / jour, 600 mg d'oignon / kg / jour et 600 mg de $Na_2S_2O_3$ / kg / jour respectivement pendant 2 semaines avant la co-administration avec du cyanure. Les paramètres du stress oxydatif ont été estimés dans le cerveau.
Résultats: Le niveau de Malon-dialdéhyde (MDA), le taux réduit de glutathion (GSH), la glutathion-S-transférase (GST) et l'activité du lactate déshydrogénase (LDH) dans le cerveau des rats traités avec du cyanure étaient significativement plus élevés ($p <0,05$) par rapport au témoin. Cela a été accompagné d'une diminution significative ($p <0,05$) dans les enzymes antioxydants, le super-oxyde dismutase (SOD) et la catalase. Co-administration avec de l'oignon ou du $Na_2S_2O_3$ réduit de manière significative ($p <0,05$) le niveau d'activité MDA, GST et LDH dans le cerveau. Il y a eu une augmentation significative ($p <0,05$) dans les activités de SOD, de catalase et de niveau de GSH dans le groupe co-administré d'oignons par rapport au groupe traité au cyanure.
Conclusion: Les résultats suggèrent que l'extrait d'oignon peut protéger contre le stress oxydatif induit par le cyanure dans le cerveau des rats Wistar mâles.

Mots-clés: *Oignon, thiosulfate de sodium, peroxydation lipidique, antioxydant, cyanure, stress oxydatif.*

Introduction

Cyanide is a serious environmental pollutant that is extremely toxic to several forms of life because of its inhibitory activity on a variety of key enzymes [1]. One major enzyme inhibited by cyanide is the cytochrome c oxidase enzyme in which it blocks flow of electrons through complex IV to inhibit oxidative metabolism [2]. The inhibition of cytochrome c oxiase enzyme leads to reduction in ATP generation in the tissue. Reduced production of ATP in the brain may result in neuronal stimulation in which asterocyte energy demand is met by lactate [3]. This results in an increase in the activity of lactate dehydrogenase enzymes (LDH). The brain is particularly susceptible to cyanide toxicity because of its high energy demand and dependence on ATP from anerobic process [4]. Decrease in brain ATP levels and lactic acidosis may lead to disturbances in neuronal activities.

Cyanide poisoning may result from exposure to hydrocyanic acid and cyanide salts [5] as well as to various cyanogenic compounds. In plants, cyanide is usually bound to sugar molecules in the form of cyanogenic glycosides and is believed to protect the plant against herbivores.

Cassava roots (*Manihot esculenta Crantz*) is an important potato-like food grown in tropical countries that contains cyanogenic glycosides [6]. It is an important source of calories for majority of people living in the tropical countries [7]. Because of the presence of cyanoglycosides, cassava is potentially toxic to human populations that subsist on cassava-based diets with low ingestion of protein. Cyanide is a potent neurotoxin and its effects are mediated through lipid peroxidation. Various antioxidant enzymes are affected by cyanide [8] , this include catalase, SOD, and glutathione peroxidase [9].

Allium cepa linn, is used as a foodstuff, condiments, flavouring, and applied in folk medicine [10]. Botanically, the Allium species is included in the family Liliiaceae.. They are rich in two secondary metabolites that have perceived health benefits [11]. These are the organosulpur compounds [alk(en)yl cysteine sulphoxides, (ACSOs)] and the flavonoids (quercetin, anthocyanins and allixin). Flavonoids and organosulpur in onion possess chelating, free radical scavenging and antioxidant activities [12].

It is possible that the organosulphur and flavonoid contents of red onion confer protective effect in cyanide poisoning by its antioxidant properties. Thus, this study was designed to evaluate the possible ameliorative effect of the crude methanol extract of red onion on the changes in oxidative stress indices in the brain of Wistar rats during cyanide toxicity.

Materials and method

This present research was carried out in the Department of Biochemistry, University of Ibadan, Nigeria.

Plant collection and preparation of extracts

Fresh bulbs of red onions were bought and authenticated in the Department of Botany, University of Ibadan. Nigeria.

Extraction of plant material

Onions were washed with distilled water and allowed to air dry for one hour. The outer covering of the onions were manually peeled off. The peeled bulbs were washed and treated as follows: A sample of the onion bulb weighing 786g was blended in 200g of ice and then soaked in 1000mls of absolute methanol for 72hr in a clean glass container following which it was filtered using a sterile muslin cloth. The extract dried in a rotatory evaporator and stored in a refrigerator until required.

Experimental procedure

Thirty-six male Wistar rats (180-200g) obtained from the animal colony of the Department of Veterinary Medicine, University of Ibadan were used for the experiment. All animals were kept under standard condition and had free access to drinking water and food. The animals were acclimatized for two weeks to their environment and diet before the experiment.

The rats were divided into six groups (1, 2, 3, 4, 5 and 6) of six rats per group. Group 1 served as control and received 0.5ml of distilled water orally. Group 2 was treated orally with (600 mg/kg) methanol extract of *Allium cepa*. Group 3 was treated orally with 7mg/kg potassium cyanide (KCN). Group 4 was treated orally with (300 mg/kg) methanol extract of *Allium cepa*+7mg/kg KCN. Group 5 was treated orally with (600 mg/kg) methanol extract of *Allium cepa*+7mg/kg KCN. Group 6 was treated orally with (600 mg/kg) sodium thiosulphate+7mg/kg KCN. Groups 4, 5 and 6 were pre-treated with 300 mg/kg of methanol extract of *Allium cepa,* 600 mg/kg of methanol extract of *Allium cepa* and 600 mg/kg of sodium thiosulphate for two weeks. The animals were observed daily and weighed weekly during the period of the study. They were also maintained on their respective diets for this period. At the end of experiment, animals were fasted overnight and then sacrificed the next day by cervical dislocation. Blood was collected into plain tubes and these were centrifuged at 3,000g for 10 minute to produce serum. The rat's brain was removed immediately and rinsed in 1.15% ice-cold KCl. Dry

Table 1: Relative brain weight, brain Malondialdehyde level, Serum and brain LDH activity in Sub acute Toxicity following oral administration of 7mg/kg KCN in rats

	Relative brain weight (g tissue/ Kg bw)	Serum LDH activity (IU/L)	Brain LDH activity (IU/L)	Malondialdehyde (MDA) level (μg/g tissue)
Control	7.07±0.007	736.70±48.90	36.06±2.12	1.89±0.07
Onion only	7.04±0.050	694.90±62.10	38.45±1.98	1.64±0.12
Cyanide only	7.29±0.005[abxyz]	1702.50±92.10[abxyz]	130.24±3.21[abxyz]	2.24±0.14[abxyz]
Cyanide+300 mg onion extract	7.18±0.002[ab]	1220.00±74.30[ab]	85.67±2.19	1.69±0.05
Cyanide+600mg onion extract	7.16±0.001[ab]	1101.00±50.10[ab]	78.18±2.86	1.55±0.05
Cyanide +sodium thiosulphate	7.20±0.003[ab]	1319.80±101.20[ab]	80.14±2.45	2.01±0.03

(a) shows a significant different between the group and the control (b) shows a significant different between the group and 600mg/kg onion extract (onion only) group. (x) shows a significant different between the group and cyanide + 300mg onion extract group .(y) shows significant difference between that group and cyanide + 600mg onion extract group.(z) shows a significant different between that group and cyanide + sodium thiosulphate group.

weight of the brain was taken using digital weighing balance (OHAUS electronic weighing balance, Model 031-02-00.0D34). They were then homogenized in phosphate buffer (pH 7.4) and centrifuged in cold centrifuged at 10,000g for 10minutes to obtain the post mitochondria fraction for the biochemical assay. All animal experiments were conducted in accordance with International ethical norms on Animal Care and Use as contained in NIH publication/80-23, revised in 1985

Biochemical analysis

Lactate dehydrogenase (LDH) activities in both the serum and the brain were assessed using commercially available Randox LDH Kit (Randox laboratory UK). Level of lipid peroxidation in the brain was evaluated by method of Buege and Aust [13], catalase activity in the brain was evaluated by method of Sinha [14], SOD activity in the brain was evaluated by method of Misra and Fridovich [15], GST activity in the brain was evaluated by the

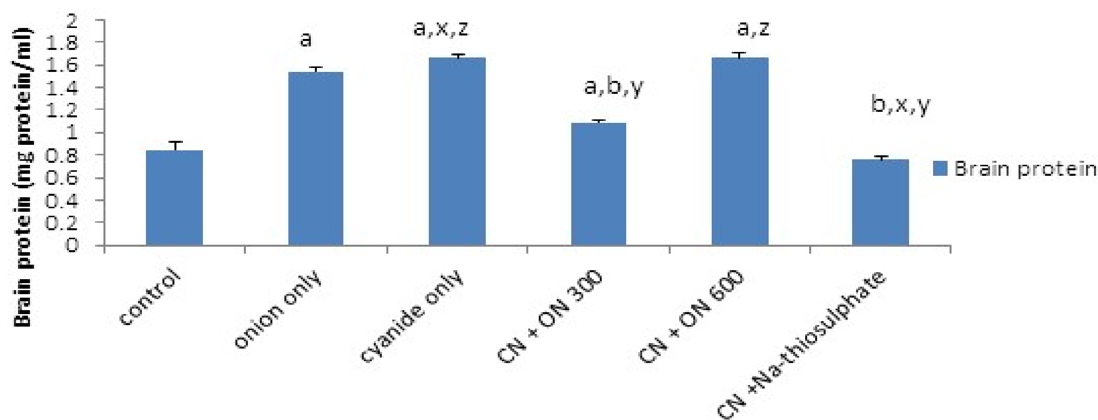

Fig. 1: Protein level in the brain during sub acute toxicity following oral administration of 7mg/kg KCN in male albino rats. (CN) cyanide, (ON) onion

(a) shows a significant different between the group and the control (b) shows a significant different between the group and 600mg/kg onion extract (onion only) group. (x) shows a significant different between the group and cyanide + 300mg onion extract group .(y) shows significant difference between that group and cyanide + 600mg onion extract group.(z) shows a significant different between that group and cyanide + sodium thiosulphate group

method of Habig *et al*., [16] GSH content in the brain was evaluated by the method of Beutler *et al.,*[17]

Statistical analysis

Data were presented as mean ± standard error of mean (SEM) and one way ANOVA followed by Turkey's post hoc test was used for comparison of mean. $P < 0.05$ was considered statistically significant. Data were analysed with the use of Graphpad Priem Version 5.0 for windows (Graphpa® software, San Diego, CA, USA)

Results

Effects of methanol extract of Allium cepa Liin on relative brain weight and biochemical parameters

The relative brain weight of the cyanide-treated group was significantly higher ($p< 0.001$) when compared with the control group. However, the relative brain weight was significantly reduced after treatment with the onion extracts ($p< 0.01$) and 600mg/kg $Na_2S_2O_3$ ($p< 0.05$) when compared to the cyanide-treated group (Table 1).

Table 1 shows the results of serum LDH and brain LDH respectively. The activities of brain and serum LDH in the cyanide-treated groups were significantly increased ($p< 0.001$), when compared to the control rats. However, treatment with onion extracts and 600mg/kg $Na_2S_2O_3$ significantly reduced ($p< 0.001$) LDH activities when compared with the cyanide-treated group.

As indicated also in table 1, the concentration of MDA was significantly increased ($p< 0.05$) in the brain of cyanide-treated rats when compared with the control. Treatment with onion extracts and 600mg/kg $Na_2S_2O_3$ however significantly decreased ($p<0.05$) the MDA concentration relative to the cyanide-treated rats.

Presented in table 2 is the result of SOD activity and the activity of catalase in rat's brain. The brain SOD and catalase activities for cyanide-treated group was significantly reduced ($p< 0.001$ and $p<0.05$ respectively) relative to the control group.

Treatment with 600mg/kg onion extract significantly increased the SOD ($p< 0.05$) and catalase ($p< 0.01$) activities when compared with the cyanide-treated group, while treatments with 300mg/kg onion extract and 600mg/kg $Na_2S_2O_3$ showed no significant change.

As shown in table 2, the activity of GST was significantly higher ($p<0.05$) in cyanide-treated group when compared with the control group. Treatment with the onion extracts and 600mg/kg $Na_2S_2O_3$ significantly reduced ($p<0.05$) the activity of GST compared to cyanide –treated group.

The GSH level of cyanide-treated group was significantly increased ($p<0.05$) relatively to that of the control. Co-administration of onion extracts increased significantly ($p<0.001$) the GSH level while it was significantly decreased ($p<0.05$) by Co-administration of 600mg/kg $Na_2S_2O_3$ (Table 2).

Table 2: Brain GSH level, SOD, Catalase and GST activity in Sub acute Toxicity following oral administration of 7mg/kg KCN in rats

	Superoxide dismutase SOD) activity ((U/mg/ml protein)	Catalase activity (kat f)	GST activity (nmol/min/mg protein)	GSH level (µg/ml)
Control	4.70±0.24	0.042±0.002	0.025±0.004	2.90±0.13
Onion only	5.20±0.25	0.046±0.005	0.036±0.004	7.00±0.21
Cyanide only	2.20±0.23^{aby}	0.023±0.001^{aby}	0.10±0.08^{abxyz}	3.98±0.10^{abxyz}
Cyanide+300 mg onion extract	3.00±0.29^{ab}	0.036±0.005	0.028±0.004	5.30±0.13^{aby}
Cyanide+600mg onion extract	3.80±0.59	0.043±0.002	0.033±0.003	7.53±0.12^{a}
Cyanide +sodium thiosulphate	2.80±0.25^{ab}	0.029±0.006	0.046±0.004	3.45±0.14^{bxy}

(a) shows a significant different between the group and the control (b) shows a significant different between the group and 600mg/kg onion extract (onion only) group. (x) shows a significant different between the group and cyanide + 300mg onion extract group .(y) shows significant difference between that group and cyanide + 600mg onion extract group.(z) shows a significant different between that group and cyanide + sodium thiosulphate group.

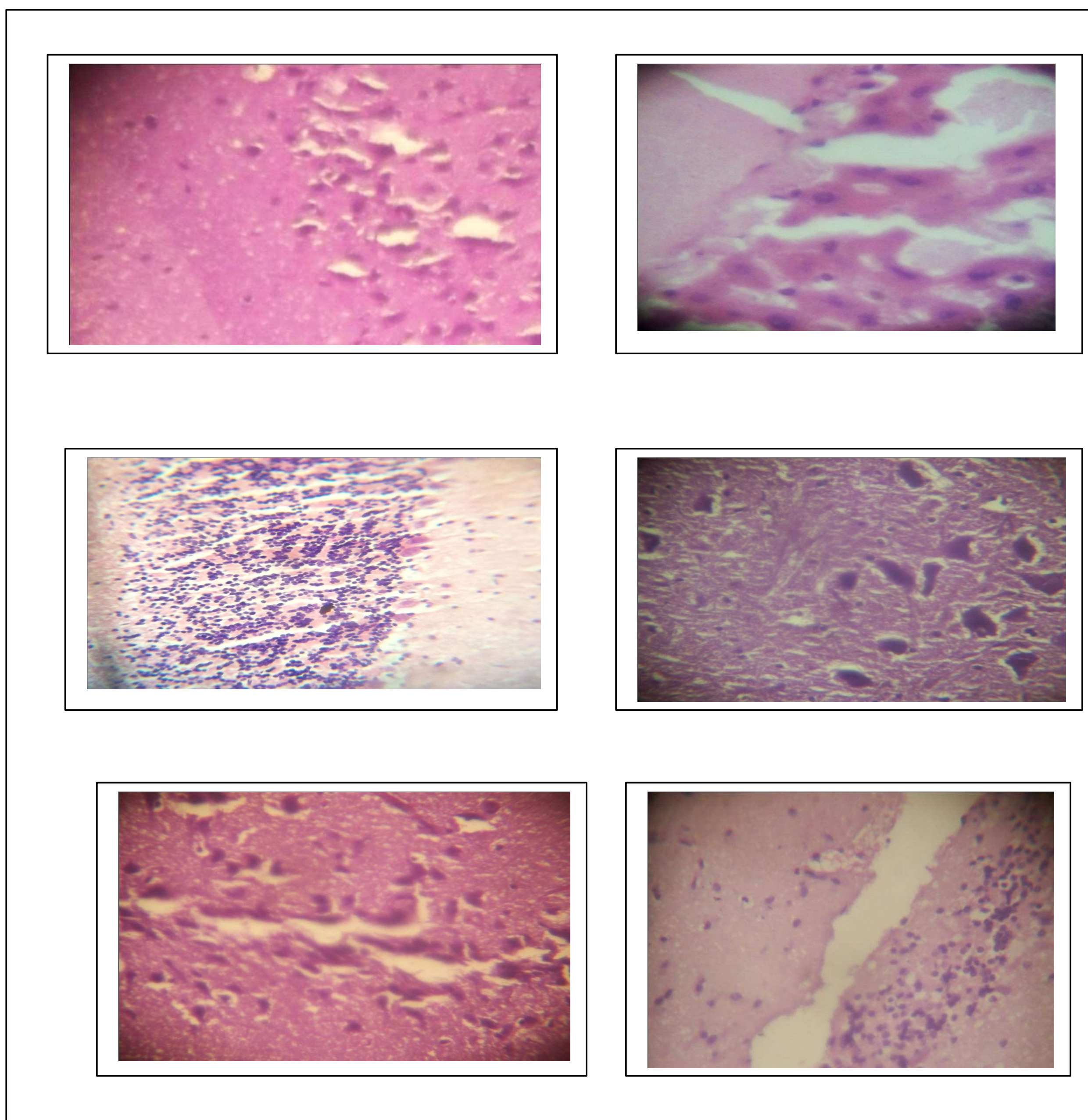

Fig. 2: Photomicrograph of brain sections following oral exposure to 7mg/Kg KCN A, B, D, E, F show the photomicrograph of brain sections of control, onion only, sodium thiosulphate+KCN, KCN + 600mg onion extract and KCN+ 300mg onion extract groups with no pathological lesion. However, C shows the photomicrograph of brain section, of group treated with KCN only. There are hyalinized and bloated purkinje cells along the edge of granular layer (white arrow).

The level of brain protein presented was significantly increased ($p<0.05$) in the cyanide-treated groups with respect to the control group (figure 1). Co-administration of 300mg/kg onion extracts and 600mg/kg $Na_2S_2O_3$ produced a significant decrease ($p<0.05$) in the brain protein level when compared with the cyanide-treated groups while the level of protein for 600mg/kg onion extract co-administered group was not significantly different from the cyanide–treated rats.

Effects of methanol extract of Allium cepa Lin on histology of the brain

Fig. 2 shows the photomicrograph of the brain following cyanide treatment. Fig.2C is the photomicrograph of brain section, of group treated with KCN only, showing hyalinized and bloated purkinje cells along the edge of granular layer. Treatment with methanol onion extract and sodium thiosulphate protected against such defect.

Discussion

The toxic effect of cyanide is attributed mainly to the inhibition of cytochrome C-oxidase; the terminal respiratory chain enzyme. This is due to the ability of cyanide to form complex with metals, such as the heme ion in cytochrome c-oxidase. Inhibition of this enzyme results in the interruption of the electron transport chain and oxidative phosphorylation. Severe ATP depletion occurs as energy is produce mainly by anaerobic respiration [2].

The result of this study showed that cyanide elevated serum and brain LDH activities. The presence of onion extract, and $Na_2S_2O_3$ however ameliorated the effect of cyanide on brain and serum LDH activities (table 1). Okolie and Osagie, [18] had reported that in rabbits, serum activities of lactate dehydrogenase, was raised by cyanide while the activities of these enzymes have been reported to be reduced by onion extract in diabetic rats [19].

Lactate dehydrogenate is located in the cytoplasm and thus easily released when cells such as those of the liver, brain, kidney and heart are damaged. Increase in activities of this enzyme in the serum may therefore be an indicator of brain damage during sub acute cyanide toxicity. Increase in the activity of serum LDH may also indicate increased production of lactic acid i.e. lactic acidosis due to inhibition of cytochrome C-oxidase resulting in increased anaerobic respiration in cyanide exposed rats [20]. The brain is a target organ for cyanide and cytotoxic hypoxia. Decrease in brain adenosine triphospahte (ATP) levels and lactic acidosis leads to disturbances in perception and the loss of consciousness.

These above well-known observations are supported by what was observed in this study in which animals on sub acute cyanide doses went into coma and were presented with elevated brain LDH activities. Reduced production of ATP in the brain via the normal aerobic process may result in neuronal stimulation in which astrocytes need a readily metabolized energy source than glucose (as they actively expend ATP) to support a variety of neuronal functions. This supply of energy can be met in lactate, the production of which is therefore increased in the peripheral processes which surround the synapse, where D-glucose and glycogen are metabolized anaerobically to lactate in order to generate the ATP required to restore ionic gradients [3]. Thus, the increased activity of brain LDH may be attributed to the increased generation of ATP from lactate in the brain.

Sub acute cyanide poisoning has been characterised by prolong energy deficit, loss of ionic homeostasis and oxidative stress leading to CNS pathology [21]. Beside cytochrome C-oxidase, cyanide also binds and inhibits other metalloproteins such as catalase. Also the interruption of the electron transport chain by cyanide results in an increase in the generation of free radicals such as superoxide ion. Therefore Cyanide toxicity leads to increased generation of superoxide anion and lipid peroxidation [22].

In this study, cyanide increased malondialdehyde (a product of lipid peroxidation) concentration (table1), with associated decrease in activity of scavenging enzymes such as catalase and superoxide dismutase (SOD) in the brain of these animals (table 2). A decrease in the activities of these enzymes can lead to the excessive availability of superoxides and peroxy radicals, which in turn generate hydroxyl radicals resulting in oxidative stress. This observation is consistent with the findings of Bhattacharay *et al*., [23] who reported that cyanide caused lipid peroxidation in mouse brain and inhibited various antioxidant enzymes such as SOD and catalase. Co-administration of methanol extract of onion however decrease malondialdehyde level (MDA) (table 1) and increase the activity of catalase and SOD in a dose dependant manner (table 2). Sodium thiosulphate although decrease the MDA level, but it only has slight effects on the activity of SOD and catalase. Kumari and Augusti [24] reported that organosulphur compounds such as s-methylcysteine sulphoxide (SMCS), isolated from onion had antioxidant effect, while Tang and Cronin [25] indicated that quercetin, the main antioxidant in onion juice, has free radical scavenging activities, chelate transition metal and inhibit oxidase such as lipoxygenase. The effects of onion extract observed in this study may be due to the above mentioned properties. The result of this study is supported by other studies where increased total antioxidant level and SOD activity in the lens has been shown to be associated with instillation of onion juice into the rat eyes [26]. Hussien *et al*., [27] have also shown that onion oil increased the activity of SOD and decreased MDA level.

A non-enzymatic antioxidant in the body is reduced glutathione; a reducing agent in the biological cells that provides primary antioxidant defence against reactive intermediates of metabolism, drug or carcinogens [28]. Glutathione S-transferase (GST) also plays an important role in the detoxification and metabolism of many xenobiotic compounds [29] by conjugating them with reduced glutathione. The present study showed an increase in the non enzymatic antioxidant

glutathione (GSH) content in the brain of all the treated groups. However, the activity of GST was only increased in the brain of animals on cyanide (table 2). Onion has been shown to increase GSH activity in the liver of rats [27], while Fahmy and Magedah [30] reported an increase in GSH activity in the liver and kidney of rats co-administered with sodium thiosulphate. Although the reason for increased concentration of GSH and GST activity in the brain of animals on cyanide is not known, but it may be due to induction (which was more pronounced for GST) as a result of increase in the generation of free radical. Shivarajashankara *et al.,* [31] have also shown that exposure to oxidant stress can lead to adaptive response in the form of increased GSH level. Other toxic substances such as endosulfan have been shown to increase GST activity in the extrahepatic tissue [32]. Increase in the activity of GST and GSH level in the brain of cyanide treated rats might be one of the defence mechanisms in these animals to detoxify or neutralise toxic metabolites and reduce oxidative stress. Although GST was significantly increased in the brain of cyanide treated rats, the decreased SOD and catalase activities might have accounted for the significant increase in brain malondialdehyde and therefore increased lipid peroxidation in the brain. Thus the increment in the activity of GST is not sufficient to prevent the generation of free radical.

In conclusion, this study suggests that onion extract may reduce brain damage and improve antioxidant status in animals treated with sub-acute dose of potassium cyanide.

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Abnormal haemoglobin variants, ABO and rhesus blood group distribution among pregnant women in a secondary health centre in Ibadan, South West Nigeria

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Abstract

Background: The distribution of the ABO and Rh and abnormal haemoglobin variants will determine the blood type and stock levels in hospital blood banks. This study determined the prevalence of haemoglobin variants, ABO and RhD blood group distribution among pregnant women at a secondary level hospital in Nigeria.
Methodology **-** This was a cross sectional study of healthy pregnant women attending Adeoyo Maternity Hospital, Ibadan, Nigeria. The record of every woman presenting for their first antenatal clinic visit over a 4-month period was reviewed. This included the results of haemoglobin electrophoresis and blood group.
Results **-** Thirty four records were excluded because of incomplete data. The results for 2664 women are presented. The majority (70.1%) had normal haemoglobin (Hb AA), 29.5% were heterozygous for A (AS, AC) while 0.4% had abnormal Hb variants (SS, CC, SC). Rhesus D positive rate was 93.6%. Almost half (48.1%) were of blood group O, blood groups A and B were 23.5% vs. 24.9% respectively. The least blood group was AB. The ABO gene frequencies among these pregnant women were O>B>A>AB. The phenotype frequencies with respect to ABO and Rhesus system were: $O^+ > B^+ > A^+ > O^- > AB^+ > A^- > B^- > AB^-$
Conclusion **-** The blood group distribution is such that availability of blood for transfusion will not be a challenge. Haemoglobin variants in this population are not uncommon. Genetic counselling for prospective couples, carrier screening and mutation identification are important for reducing the sickling gene pool.

Keywords: *Haemoglobin variants; RhD blood group; electrophoresis, pregnant women*

Résumé

Contexte : - La distribution de l'ABO et du Rh et des variantes anormales d'hémoglobine déterminera le type de sang et le taux de stock dans les banques de sang de l'hôpital. Cette étude a déterminé la prévalence des variantes de l'hémoglobine, la distribution du groupe sanguin ABO et RhD chez les femmes enceintes d'un hôpital de niveau secondaire au Nigeria.
Méthodologie - Il s'agissait d'une étude transversale portant sur des femmes enceintes saines qui fréquentaient la Maternité de l'Hôpital Adeoyo, Ibadan, Nigeria. Le registre de chaque femme qui présentait pour sa première visite à la clinique prénatale sur une période de 4 mois a été examiné. Cela comprenait les résultats de l'électrophorèse de l'hémoglobine et du groupe sanguin.
Résultats - Trente-quatre enregistrements ont été exclus en raison de données incomplètes. Les résultats pour 2664 femmes sont présentés. La majorité (70,1%) avaient une hémoglobine normale (Hb AA), 29,5% étaient hétérozygotes pour A (AS, AC), tandis que 0,4% avaient des variantes Hb anormales (SS, CC, SC). Le taux de positivité de Rhésus était de 93,6%. Près de la moitié (48,1%) étaient du groupe sanguin O, les groupes sanguins A et B étaient de 23,5% contre 24,9% respectivement. Le groupe sanguin le moins élevé était AB. La fréquence des gènes ABO parmi ces femmes enceintes est: O> B> A> AB. Les fréquences phénotypiques par rapport au système ABO et Rhesus sont: $O^+ > B^+ > A^+ > O^- > AB^+ > A^- > B^- > AB^-$
Conclusion - La distribution du groupe sanguin est telle que la disponibilité du sang pour la transfusion ne constituera pas un défi. Les variantes de l'hémoglobine dans cette population ne sont pas inusuelles. Le conseil génétique pour les couples potentiels, le dépistage des porteurs et l'identification des mutations sont importants pour réduire le pool de gènes maladif.

Mots-clés: *Variantes d'hémoglobine; Groupe sanguin RhD*

Introduction

Haemoglobinopathies are inherited disorders of haemoglobin [1]. These disorders of haemoglobin are the most common gene disorders with 5.5% of the world's population and 7% of pregnant women being carriers [1-4]. Over 700 haemoglobin disorders have been described with only a few having clinical significance. There are two major groups: the structural haemoglobin variants and the quantitative

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abnormalities - thalassemias. Of the haemoglobin variants, sickle cell disease is the commonest haemoglobinopathy of epidemiological importance with significant clinical manifestations among blacks of African ancestry [5]. The highest prevalence of sickle cell disorders is found among people of African or West Indian (Caribbean) descent [6] with a rate of 20-30%. Indeed the highest prevalence of sickle cell disease (HbS) has been reported from Nigeria [7]. It is the most common haemoglobinopathy to complicate pregnancy and may result in small babies [8].Other haemoglobin variants are Haemoglobin C,D, and E. Homozygote D and E are mildly symptonmatic.

Haemoglobin is responsible for carrying oxygen round the body. The normal adult Hb is HbA, while the Hb variants are mutants of the HbA. These autosomal recessive disorders, the result of a single mutant gene, are characterized by the synthesis of structurally abnormal globin chains in these abnormal haemoglobin (Hb) variants [1, 2]. The consequence of which could result in anaemia, organ damage and adverse pregnancy outcome in affected individual. Haemoglobin S is associated with sickling disorders. Sickling disorders include the homozygous state for HbS or sickle cell anaemia (SS) and the compound heterozygous state for HbS together with other abnormal haemoglobin (C,D,E) or other structural variants [1, 2]. Hb S exerts its effect by causing precipitation and polymerization of the deoxygenated Hb S with resulting sickling of the red cells. These sickled cells have shortened life span resulting in anaemia. The cells also lack deformability, occlude the microvasculature, and lead to tissue infarction which is responsible for the manifestations of the disease.

The membrane of the human red blood cell (RBC) is complex and contains a variety of blood group antigens [2]. These antigens are coded for by the alleles at different loci on a chromosome [1]. They are actually complex oligosaccharides that differ in their terminal sugar [2]. About 400 blood grouping antigens have been reported, however ABO and Rhesus (RH) (the 1st and the 4th to be discovered respectively) are the most important [1]. The ABO system derives its importance from the fact that A and B are strongly antigenic and anti–A and anti-B occur naturally in the serum of persons lacking the corresponding antigen. These antibodies are capable of producing haemolysis in vivo [1]. Individuals are divided into one of four major ABO blood groups: A, B, AB and O depending on the presence and absence of A and B antigens present on RBC and agglutinins in the serum [9, 10].

The human RBCs that contain Rhesus antigen D are described as being rhesus positive (Rh+), while those without antigen D on their RBCs are rhesus negative (Rh-) [10, 11]. The D-antigen is immunogenic and induces an immune response in 80% of D-negative individuals when transfused with 200ml or more of D- positive blood [12]. The clinical relevance of these blood group systems relate to the capacity of alloantibodies (directed against antigens not possessed by the individual) to cause destruction of transfused RBCs (ABO antibodies) [1, 2] or to cross the placenta and give rise to haemolytic disease of the newborn (HDN) [11].

With a population of over 160 million, Nigeria accounts for a considerable proportion of maternal mortality worldwide [13]. Anaemia due to haemorrhage and haemoglobinopathy is an important cause of mortality in pregnant women (Chou *et al.* 2014). Haemoglobinopathy particularly sickle cell disease, impacts significantly on the severity and frequency of anaemia in Sub-Saharan Africa where malaria, also an important cause of anaemia, are epidemiologically related. In addition, haemoglobinopathies in pregnancy contribute to maternal morbidity and poor pregnancy outcome in Nigeria [14]. In order to reduce the morbidity and mortality, blood group of the patients are often required to transfuse compatible blood. Since ABO and Rh blood groups are the most immunologically and epidemiologically important for compatibility test, it is thus important to have knowledge of the distribution of the ABO and Rh D blood groups and abnormal haemoglobin variants in determining the type and stock levels to be maintained in the hospital blood bank as well as in the formulation of transfusion policies.

This study aimed to determine the prevalence of haemoglobin variants, ABO and RhD blood group distribution among pregnant women presenting for care at a secondary health care level in Ibadan, South West Nigeria.

Materials and methods

This was a cross sectional study of healthy pregnant Nigerian women attending Adeoyo Maternity Hospital (AMH), a secondary level health centre in Ibadan, the capital of Oyo State in the South-West of Nigeria. Adeoyo Maternity Hospital serves as a secondary maternity referral centre and as a primary facility for the people of Ibadan and its environs. The case record of every pregnant woman presenting for their first antenatal clinic visit over a 4-month period were retrieved from the medical records department of the hospital. Data were collected by

means of a prepared proforma. Data were obtained with respect to age, parity and gestational age at booking. The women were categorized into the traditional first (≤ 13 weeks), second (14-26 weeks) or third (≥26 weeks) trimesters. Women with incomplete data were excluded from the study. All were offered a panel of investigations including haemoglobin electrophoresis, packed cell volume, blood group etc.

All aspects of this study complied with the Helsinki declaration of the 52nd World Medical Association General Assembly of October 2000.

Statistical analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS for windows versions 11.0, SPSS Inc., Chicago IL). Data were summarized as means ± standard deviation, simple percentages and mode.

Results

During the period under review, 2698 women presented for care. Thirty four did not have their blood group or haemoglobin electrophoresis results documented. They were excluded from further analysis. The results for 2664 women are presented here. The mean age of the women was 27.35years (± 5.34). The mean packed cell volume was 30.97% (± 4.13). The mean gestational age at presentation was 26.37 weeks (± 6.37).

Table 1 shows the distribution of selected demographic characteristics, normal and abnormal haemoglobin variants. The modal parity was para 0. Most women booked after the first trimester of pregnancy. Most were in the age group 20-34 years. In this cohort of pregnant women, the majority (70.1%) had normal haemoglobin (Hb AA). Almost a third (29.5%) were heterozygous for A (AS, AC,) while less than one percent (0.4%) had homozygous abnormal Hb variants (SS, CC).

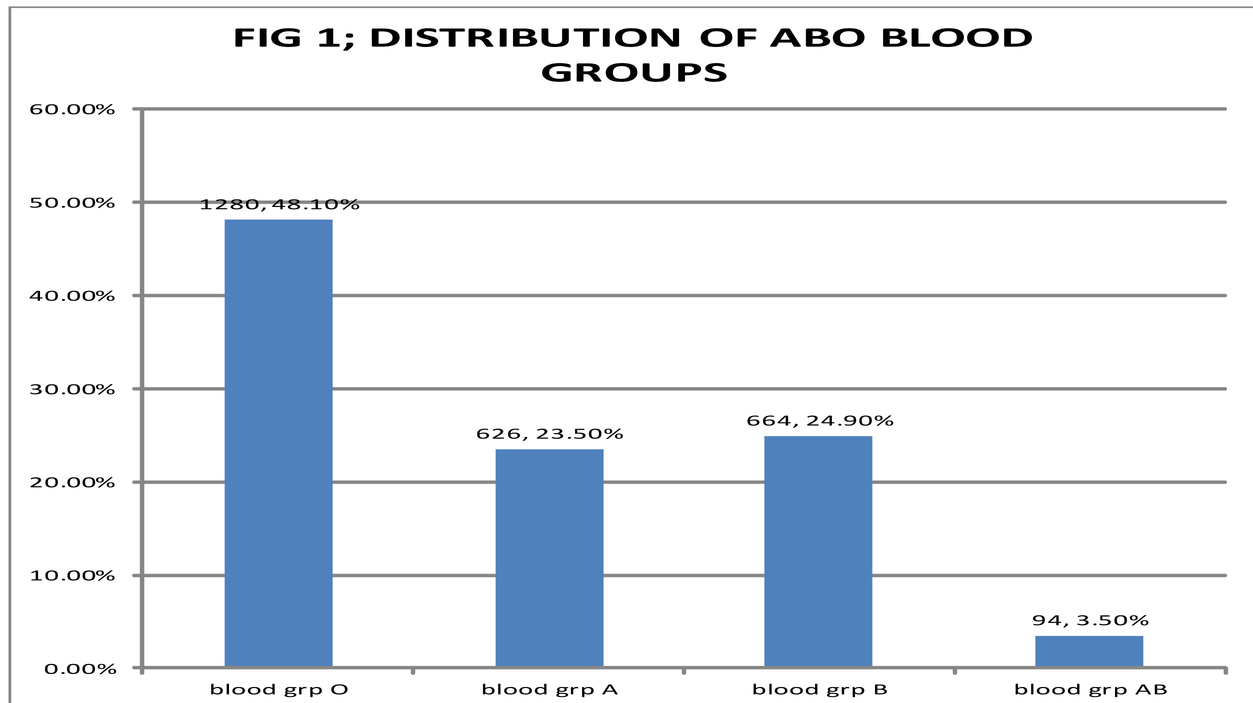
Table 2 showed the distribution of Rhesus blood groups according to ABO blood types. Rhesus positive rate was 93.6% while Rhesus negative accounted for 6.4% for the total population studied. Almost half (48.1%) were of blood group O, blood groups A and B were almost evenly distributed (23.5% vs. 24.9% respectively). The least blood group was blood group AB. The gene frequencies with respect to ABO in this population of pregnant women can be shown as: O>B>A>AB. Thus the phenotype frequencies with respect to ABO and Rhesus system can be shown as: $O^+ > B^+ > A^+ > O^- > AB^+ > A^- > B^- > AB^-$

Table 1 – Distribution of selected demographic characteristics and haemoglobin variants

Variable	Frequency (2664)	Percentage
Age of patient		
≤19	132	5.0
20-24	644	24.2
25-29	959	36.0
30-34	594	22.3
≥35	335	12.6
Parity		
0	960	36.1
1	656	24.6
2	536	20.1
3	333	12.5
4	139	5.2
≥5	40	1.5
Trimester at booking		
≤13 weeks	91	3.4
14-26 weeks	1201	45.1
≥26 weeks	1372	51.5
Genotype		
AA	1868	70.1
AS	589	22.1
AC	175	6.6
SC	20	0.8
SS	9	0.3
CC	3	0.1

Table 2: Distribution of Rhesus blood groups according to ABO blood types.

ABO blood group	RH +ve (freq, %)	RH –ve (freq, %)	Total (%)
O	1190(44.7%)	90(3.4%)	1280(48.1%)
A	587(22.0%)	39(1.5%)	626(23.5%)
B	63(23.7%)	32 (1.2%)	664 (24.9%)
AB	86(3.2%)	8(0.3%)	94(3.5%)
Total	2495(93.6%)	169(6.4%)	2664 (100.0%)



Discussion

In this cohort of pregnant women, the frequencies of HbAA, HbAS and HbAC were 70.1%, 22.1% and 6.6% respectively. This is similar to the pattern of 71.04%, 19.67% and 6.19% respectively reported by Akhigbe *et al* 2009 [1] working among students of a tertiary institution in Ogbomosho, also in south west Nigeria. It is, however, different when compared to the cohort of female students of African descent in a tertiary institution from the Niger Delta of Nigeria that was reported as 68.03%, 30.33% and 0% respectively [2]. The frequency of HbAS detected in this study 22.1% is consistent with previous studies in Nigeria and other African settings which observed a prevalence of 20-40% in Africa in general [1, 2, 15-17] suggesting a stability of the frequency of the AS gene in our environment and the need for continued surveillance. These women will need to be counselled and enquiry made into the Hb genotype/phenotype of their husbands. In other reports, the geographical distribution has been given as 8-16% for African Americans and 6-15% for Europeans (United Kingdom among Pakistanis and Blacks).In Kenya, it was reported as 26% in the lowlands and 3% in the highlands [2, 18].

The prevalence of HbSS , HbSC and HbCC was comparable to the result obtained by Akhigbe *et al* working in the same region [1]. In contrast, Erhabor *et al* working in the Delta region of Nigeria reported prevalence of 1.64%, for HbSS, with the absence of HbSC and HbCC [2]. A much higher rate of 2-3% HbSS was also reported in the Eastern part of Nigeria (same country) [19, 20]. Frequency of HbSS less than 0.3% observed among our patients was from a study outside Nigeria, (in Kenya, East Africa) in which a 0% prevalence for HbSS was observed [18]. The zero frequencies observed in that study was attributed to the fact that the sickling gene pool may gradually be reducing in African populations particularly those with an abnormal haemoglobin carrier screening and genetic counselling program for the prevention of haemoglobin disorders [2]. In other reports, the geographical distribution in the general population has been given as: 3-9% for African Americans, 3-7% for Europeans (United Kingdom among Pakistanis and blacks) and 1-3% for Caribbeans [2, 17].

Sickle cell disease (SCD) is now seen more frequently in pregnancy because of the increased survival of affected women into adulthood [14] . Although maternal and perinatal mortality have recently been reported to be reduced for women with SCD [21, 22], they are still prone to several complications during pregnancy including anaemia, severe crises, pulmonary disease and infections [23-25]. Sickle cell disease patients will therefore need close monitoring during pregnancy. Perinatal mortality rates are also higher than those for their haemoglobin AA counterparts worldwide [23, 24, 26] and low birth weight is thought to be one of the predisposing factors to this high mortality rate [26].

The burden of disease among people with homozygous SS in Nigeria is high. With a population

of 160 million, 0.3% translates to 480,000 individuals. The potential for more individuals with this pathology to be added to the population is present given the 22.1% frequency of HbAS in this population of pregnant women. In order to reduce the burden of this scourge, certain interventions have been recommended. These include increasing the awareness of sickle cell anaemia among the populace, increased uptake of genotyping prior to marriage and child bearing and increasing access to prenatal diagnosis of genetic haemoglobin disorder [1]. Other interventions include the universal neonatal screening program, an effective way to diagnose the presence of haemoglobinopathy, which has been described as an excellent health education tool [27]. Although, these programs require major economic and organizational resources, the benefits are pivotal to development as it will improve the health of the populations affected by these disorders [2].

The results from this study show that blood antigen O predominates. We observed that 48.1% of our subjects were group O, 24.9% were group B, 23.5% were group A while 3.5% were group AB. Blood group AB exhibited the least incidence in this study. The results from this study showed that the frequencies of ABO systems are in the order of O> B> A> AB. Among female students in a tertiary institution also in south west Nigeria,[1], the distribution of ABO blood group was reported as follows: 54.1% are group O, 21.68% are group B, 21.49% are group A and 2.73% are group AB (O> B> A> AB). The results from a tertiary institution in Niger Delta was 35% blood group O, 35% blood group A, 27.5% blood group B and 2.5% blood group AB (O> A> B> AB) [2]. American blacks generally demonstrate frequencies of O, A, B and AB blood groups of 49%, 27%, 20% and 4%, respectively (O> A> B> AB). A previous report which focused on Yoruba and Hausa ethnic groups in Nigeria by Worlledge *et al* [6, 28] indicated that 58% were group O, 21% were group A, 17% were group B and 2% were group AB . However, an exception to this can be observed among the Gwari tribe of Abuja and the Rubuka tribe of the Plateau state of Nigeria in which the group B was the predominant ABO blood group [2]. In addition, some Eastern Europeans have a higher proportion (up to 40%) of group B blood, while pure American Indians belong exclusively to blood group O [15].

The similarity of the blood group frequency seen in this cohort, especially a high frequency of blood group O, to that of the general population who are potential donors is an advantage for availability of blood for transfusion purpose in emergencies. It is known that blood group O individuals lack ABO blood group antigens on their red cells and thus their blood can theoretically safely be given to people of blood groups A, B and AB. However, some level of caution is advised [1]. This is because the plasma of some group O blood individuals is known to contain high titer of potent A and B immune haemolytic antibodies (haemolysins). It is therefore recommended that routine haemolysis testing should be carried out on all group O blood samples to allow those containing high titer haemolysins to be reserved specifically for group O patients [2]. Besides the importance of blood group in blood transfusion of the anaemic pregnant woman, the blood group O has been associated with less pregnancy adverse outcome compared with other blood groups [29, 30].

The incidence of Rhesus D antigen in this study was 93.6%, while Rh D negative accounted for 6.4% of the study population. This is similar to the Rhesus D antigen rate of 96.7% recorded for Ibos in South-East Nigeria by Ukaejiofor *et al* [31], 93.3% reported by Akhigbe *et al* from Ogbomosho South West Nigeria [1], while Mwangi in Kenya reported 94% [32]. The percentage of Rh D negative reported here is much lower that the prevalence rate of $\geq$ 14% Rh D negative phenotype observed in studies among Caucasians [33, 34]. The obstetric implication of the low prevalence of Rh D-negative in this cohort of Nigerian women is that RhD allo-immunization problem maybe of a much smaller magnitude than it is in most western countries. The Rhesus blood group system is the second most clinically significant red cell antigen system after the ABO blood group system. The likelihood of becoming sensitized to the D antigen following exposure by transfusion of Rh D positive red cells or during pregnancy involving a Rhesus positive fetus is very high and the antibody produced as a result of such immunization has serious clinical effects including haemolytic disease in the newborn and /or transfusion reactions [2].

In conclusion, the blood group distribution of these pregnant women is such that availability of blood for transfusion will not be a challenge. Haemoglobin variants in this population are not uncommon. Genetic counselling for prospective couples, carrier screening and mutation identification are important for reducing the sickling gene pool.

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Knowledge of vasectomy and barriers to modern contraception among married men in a traditional community, South-West, Nigeria

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Abstract

Background: Family Planning (FP) is central to fertility and maternal mortality reduction. Unfortunately, the contraceptive prevalence rate is low in Nigeria and the prevalence of the only permanent method for male is strikingly low. The objectives of the study are to determine knowledge of vasectomy and identify barriers to modern contraception among married men in Ife Central Local Government Area (LGA), Nigeria.
Methods: The study design was cross-sectional and involved a mix-method approach. One thousand married men participated in the study; 3focused group discussions and 2 key informant interviews were also conducted. Data were analysed using thematic approach and logistic regression model (Alpha=0.05).
Results: Mean age of the respondents was 38.5±5.2 years and 1.3% was sterilized. About 3.5% had adequate knowledge of vasectomy (AKV). The identified predictors of AKV were; place of residence, occupation, income and level of education. Living in the rural areas inhibits AKV (OR=0.39;C.I=0.27-0.59,p<0.001). Sexual pleasure, fear of side effect, limited number of contraceptive choices for men, promiscuity, infertility and financial incapacity to manage complications were cited as reasons for non-use of FP.
Conclusion: Adequate knowledge of vasectomy is low among married men in Ife Central LGA. Strategies to scale-up male involvement in FP should be enhanced in the study area.

Keywords: *Family planning, Vasectomy, Ile-Ife*

Résumé

Contexte: La planification familiale (PF) est essentielle à la fertilité et à la réduction de la mortalité maternelle. Malheureusement, le taux de prévalence contraceptive est faible au Nigéria et la prévalence de la seule méthode permanente pour les hommes est très faible. Les objectifs de l'étude sont de déterminer la connaissance de la vasectomie et d'identifier les obstacles à la contraception moderne chez les hommes mariés dans la commune d'Ife Centrale, au Nigeria.
Méthodes: La conception de l'étude était transversale et impliquait une approche de méthode mixée. Mille hommes mariés ont participé à l'étude; 3 discussions de groupes focalisés et 2 entrevues avec des informateurs clés ont également été menées. Les données ont été analysées à l'aide d'une approche thématique et d'un modèle de régression logistique (Alpha = 0,05).
Résultats: L'âge moyen des répondants était de 38,5 ± 5,2 ans et 1,3% était stérilisé. Environ 3,5% avaient une Connaissance Adéquate de la Vasectomie (CAV). Les prédicteurs identifiés de la CAV sont: le lieu de résidence, l'occupation, le revenu et le niveau de scolarité. La vie dans les zones rurales inhibe la CAV (OR = 0,39; IC = 0,27-0,59 ; p <0,001). Le plaisir sexuel, la peur des effets secondaires, le nombre limité de choix de contraceptifs pour les hommes, la promiscuité, l'infertilité et l'incapacité financière de gérer les complications ont été cités comme des raisons de non-utilisation de la PF.
Conclusion: La connaissance adéquate de la vasectomie est faible chez les hommes mariés dans la commune d'Ife Centrale. Les stratégies visant à accroître l'implication des hommes dans la PF devraient être améliorées dans la zone d'étude.

Mots-clés: *Planification familiale, Vasectomie, Ile-Ife*

Introduction

Nigeria with population figure of above 170 million is the Africa most populous country and the population is projected to grow rapidly in such a way that it may be over 400 million by 2050 [1]. Its total fertility rate (5.5%) and growth rate of 2.5% per annum are among the highest world-wide [1]. The maternal mortality ratio is 576 per 100,000 live births with infant and child mortality of 69 and 128per 1000 respectfully [2]. Fertility can reverse the trend of these unacceptable demographic parameters if adequately controlled. Knowledge of contraception is widespread in Nigeria; 85 percent of women and

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95 percent of men report knowing about a contraceptive method [2]. Unfortunately, this degree of knowledge is yet to translate to practice in virtually all the regions and ethnic groups in Nigeria. For instance, the prevalence of modern contraceptive use among women of reproductive ages was 10.0% [2]. Also, attitude to uptake of family planning is still considered as poor. For two decades, the Nigerian government has recommended that families limit themselves to four children; with little or no effect of this agenda since it was formulated [3]. Against this background, researchers within and outside Nigeria have been curious to unravel the reasons why Family Planning Programmes have failed in the country. In most of the previous research on family planning in Nigeria, much attention has been devoted on women while those that involved men are limited [4,5]. Neglecting men from family planning matters have substantial short and long term effect on the health of women.

Social and cultural factors have been shown to influence family planning uptake in Nigeria [6-8]. To overcome some of the challenges and barriers in a traditional society like Ile-Ife, men must be fully involved. It is worthwhile to note that fertility issues are centred around women since they bear the burden of pregnancy and child rearing but men as the head of most households in Nigeria have great influence on childbearing matters [6,9]. Traditionally, the family unit in Ile-Ife is essentially patriarchal with almost all the important decisions taken by the male head while the woman's fundamental social role is to bear and raise children and engage in productive tasks within the household [10]. In most families in Ile-Ife, wives are usually socially and economically dependent on their husbands. It is rare for a woman to disagree with her husband if he wants more children or refuse sex when they are not safe or not contracepting [11]. In this context, male participation in family planning means more than increasing the number of men using the two known male methods; it also includes men who support their partner and peers to use modern contraceptives [12]. The role of man as the head of the family and communication between spouses has been identified as one of the key factors influencing the use of modern contraceptives [13,14].

In the last 4 decades, contraceptive coverage has increased rapidly in the emerging economies, facilitating stable fertility declines. Conversely, most countries in sub-Saharan Africa including Nigeria are just beginning to embrace the use of modern contraceptives. Unmet need for family planning remains high in south west Nigeria and approximately 15.4%married women who would like to limit or postpone childbearing do not currently use a contraceptive method [2]. This need could be met if men are fully involved in family planning matters [15].Previous studies have shown that men's support or opposition to their partners' practice of family planning has a strong impact on contraceptive use in many parts of the world, including Africa[13,14].Even when men do not experience the painful symptoms of health problems relating to childbearing, still they are recognized to be responsible for the large proportion of ill reproductive health suffered by women [16]. Involving men actively in reproductive decision making will reduce the incidence of unwanted pregnancy and improve acceptance of contraceptive uptake by women including its effective use and continuation [17].

Cognisance of the role that husbands play in uptake of contraceptive and with the observed low prevalence of contraceptive use in all regions in Nigeria, we therefore examined the knowledge of vasectomy among married men; identify factors influencing knowledge of vasectomy; explore factors associated with barrier to modern family planning among married men in Ife Central Local Government Area, Ile Ife, Osun State, south-west Nigeria. Information on knowledge of vasectomy and barriers to modern contraception will address men's own reproductive health concerns and also be valuable to frameworks aimed at reducing fertility and maternal mortality in the study area.

Materials and method

Study area

The study was conducted in Ile-Ife, headquarters of Ife Central Local Government Area in Osun State, Southwest Nigeria. Ile-Ife houses two Local Government Areas (LGAs) namely, Ife Central and Ife East LGAs. Specifically, Ife Central LGA consists of 11 political wards. Ife town is one of the largest urban centres in Osun State, Nigeria and the oldest town of the Yoruba people according to history. Obafemi Awolowo University is domiciled in this city and its sister institution, the Obafemi Awolowo University Teaching Hospitals Complex. There is also a public secondary health care facility, a mission hospital, and a number of primary health care facilities in the city. A few private maternity homes and hospitals also form part of the health care facilities utilized by the community. Almost all these health care facilities provide family planning services.

Study design

This study was a community based cross-sectional in design and made use of method-mix approach which consisted of quantitative and qualitative research methods. Study participants were married men (n=1000) in stable union aged 18-59 years. Stable union in the context of this study is defined as men; whoever married once, having only one wife and currently living with his wife. Only men who met these set criteria were included in the study.

Sampling techniques

The sample for this study was selected from the Enumeration Areas designed for the Local Government during 2006 Population Census exercise. At the first stage, the whole local government was stratified into 4 based on its map. Thereafter, 5 Enumeration Areas each were randomly selected from each stratum. In each of the selected Enumeration Areas, 50 households were randomly picked. This was done by constructing a sampling frame for all eligible households in each Enumeration Area and as such systematic random sampling was used to pick the households. A semi-structured questionnaire was used to collect information on socio-demographic characteristics of the study participants and knowledge of vasectomy.

Qualitative

Key Informant Interview with two Family Planning Care Providers and three Focus Group Discussions were conducted in the study area among men who are not currently using any modern contraceptive method.

Data analysis

Data were entered using SPSS software version 16.0.Descriptive statistics, Chi-square and Multivariate analysis were carried out to achieve the objectives of this study. The descriptive statistics involved frequency distribution of the respondents and summary statistics for knowledge. Ch-square analysis was conducted on knowledge level. Knowledge of vasectomy was assessed using set of questions with a 5-point scale. The overall score was disaggregated into adequate and inadequate knowledge.

$$\text{Knowledge} = \begin{cases} \text{Adequate, if score} \geq 70\% \text{ of the overal score} \\ \text{Inadequate, if otherwise} \end{cases}$$

Logistic regression was used to identify the predictors of adequate knowledge (α=0.05).
The logistic regression model is defined as;

$$pi/(1 - pi) = \exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_n x_n)$$

Where ρ_i is the outcome measure and $i = 1$ if ρ is the proportion of respondents that have adequate knowledge of vasectomy and 0 if otherwise. Also, $\beta_1, \beta_2, ..., \beta_n$ are the estimated regression coefficients; $x_1, x_2 ... x_n$ are the independent variables.

Ethical consideration

Ethical approval was obtained from Ethical Review Committee of Obafemi Awolowo University, Ile-Ife. Individual consent was also obtained from each of the participants and their confidentiality assured before the study began.

Results

The data as shown in table 1 revealed that the mean age of the respondents and mean children ever born was 38.5±5.2 years and 3.6±1.4 respectively. The highest proportion of the respondents constituted those in age group 30-39 (32.3%) and 20.4% belong to those in age group 50-59 years. Majority of the men were Christians (59.4%) compared with 39.1% Muslims and a few were traditionalists (1.5%). About 70% reside in urban area, 41.3% had higher education and 83.0% belong to Yoruba ethnic group. Twenty nine percent were civil servants, 25.4% were traders and 41.4% earn between 10,000 and 39,999 naira as monthly income.

Knowledge of vasectomy

The data show that the mean score for knowledge of vasectomy was 20.4±4.4. In table 2, the proportion of men who had adequate knowledge of vasectomy was 34.5% and 41.6% of men in age group 40-49 had adequate knowledge of vasectomy compared with 24.3% found among men aged less than 30 years ($p<0.001$). Striking difference was found between the proportion of men in urban areas (42.7%) who had adequate knowledge of vasectomy and those in the rural areas (15.6%). Men who had higher education (49.6%) have higher proportion of their members having adequate knowledge of vasectomy than their counterparts with at most primary education (26.8%) ($p<0.001$). Among various occupation groups, the highest percentage of men who have adequate knowledge of vasectomy was found among professionals (52.4%) and least among traders (20.1%). The percentage of men who have adequate knowledge of vasectomy increases constituently as the level of income increases. For all the variables considered in this study, the results from ANOVA (Mean Knowledge score) corroborate the pattern of percentage distribution.

Table 1: Frequency distribution of the respondents by socio-demographic variables

Background Characteristics	Number (1000)	Percent
Age		
< 30	235	23.5
30-39	323	32.3
40-49	238	23.8
50-59	204	20.4
Religion		
Islam	391	39.1
Christianity	594	59.4
Traditionalist	15	1.5
Place of Residence		
Urban	698	69.8
Rural	302	30.2
Level of Education		
≤ Primary	183	18.3
Secondary	404	40.4
Higher	413	41.3
Ethnicity		
Yoruba	830	83.0
Others	170	17.0
Occupation		
Trading	254	25.4
Professionals	189	18.9
Civil servants	294	29.4
Artisans	142	14.2
Others	121	12.1
Income		
<10000	149	14.9
10000-39999	414	41.4
40000-69999	260	26.0
70000+	177	17.7
Children ever born		
0-2	146	14.6
3-4	491	49.1
5+	363	36.3

Figure 1 shows the percentage distribution of 710 men who are not currently using modern contraceptive method and reasons for this behaviour. Thirty five percent of the respondents are not currently using modern method because of the fear of side effect while 25% reported that they were not aware of specific contraceptive method that suits their need and 11% said they are not using any modern contraceptive method because of the health concern.

Reasons why men would not want their wives to use modern contraceptive methods

In this study, during the focused group discussion conducted among men who are not currently using any modern contraceptive method, question was asked to ascertain why such men behave this way. During the discussions, respondents described the factors that discouraged them from currently using modern contraceptives and reasons why they and their wives will not use in future. The responses of the participants were similar in some ways and as such one of these was presented here. All respondents reported that lack of awareness, sexual pleasure (inhibiting condom use) and fear of side effect had influenced their decision on non-use of male contraceptive methods.

"Some men were not aware of contraceptive use due to their level of exposure and some complaint about the side effects of modern contraceptive use. Like me, I don't like using condom because am not really enjoying myself during sexual intercourse and whenever I wanted to have sex with my wife, I prefer flesh to flesh but immediately after the sex I told my wife to stand up so as not to get pregnant because I didn't allow her to use any of the methods of

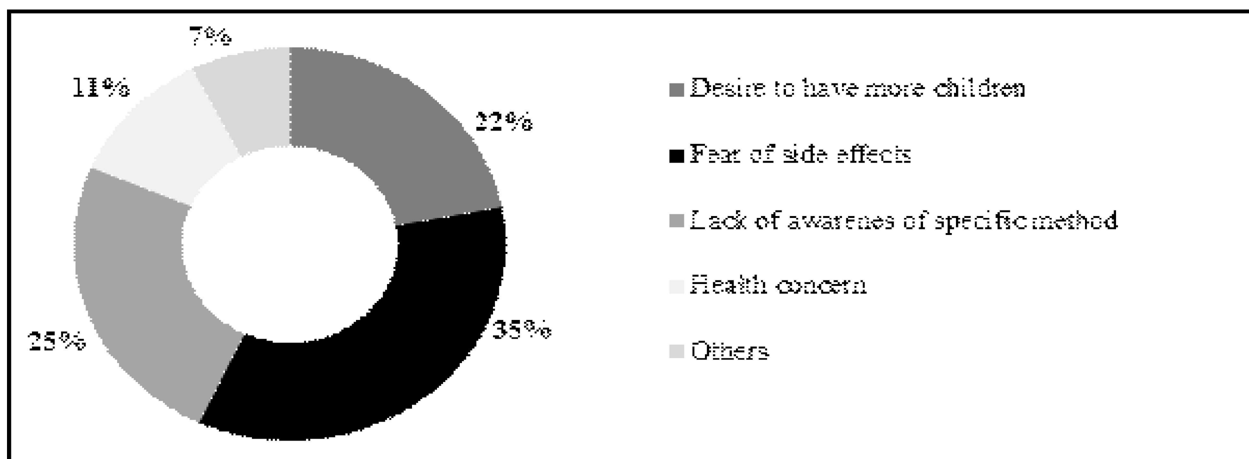

Fig. 1: Percentage distribution of respondents by reasons for non-use of contraceptive method

Table 2: Percentage Distribution of respondents' according to knowledge of vasectomy by socio-demographic characteristics

Background Characteristics	Knowledge of Vasectomy **Adequate**	χ^2-value	P-value	Total Men	Mean Knowledge
Total	34.5(345)			1000	20.4±4.4
Age		17.9*	<0.001		<0.001
<30	24.3(57)			235	19.9±4.5
30-39	34.1(110)			323	20.2±4.2
40-49	41.6(99)			238	20.8±4.4
50-59	38.7(79)			204	21.2±4.4
Religion		2.3	0.321		0.426
Islam	33.0(129)			391	20.5±4.2
Christianity	35.9(213)			594	20.4±4.6
Traditionalist	20.0(3)			15	19.5±1.9
Place of Residence	68.7*	<0.001		<0.001	
Urban	42.7(298)			698	21.2±4.5
Rural	15.6(47)			302	18.8±3.5
Level of Education	72.3*	<0.001		<0.001	
<Primary	26.8(49)			183	19.5±3.4
Secondary	22.5(91)			404	19.4±3.6
Higher	49.6(205)			413	21.9±5.1
Ethnicity		0.8	0.085		0.058
Yoruba	34.7(288)			830	20.5±4.4
Others	33.5(57)			170	20.3±4.2
Occupation		96.5*	<0.001		<0.001
Trading	20.1(51)			254	19.6±3.7
Professionals	52.4(99)			189	21.9±5.2
Civil servants	48.0(141)			294	21.5±4.6
Artisans	19.7(28)			142	19.1±3.3
Others	21.5(26)			121	18.9±4.5
Income		58.7*	<0.001		<0.001
<10000	17.4(26)			149	18.6±3.0
10000-39999	29.2(121)			414	20.1±4.3
40000-69999	38.8(101)			260	20.9±4.4
70000+	54.8(97)			177	22.2±4.9
Children ever born		1.4	0.507		0.098
0-2	34.9(51)			146	20.5±4.5
3-4	36.0(177)			491	20.4±4.1
5+	32.2(117)			363	20.5±4.7

**Significant at 0.1%; **Significant at 1%; ***Significant at 5%*

contraception. One of my friends that his wife used one of the methods of contraception, his wife was having stomach problem". (Husband, 36 years)

Research has shown that availability of varieties of products for a specific function enhances its patronage and utilization. It allows more ample opportunities of sampling the content, has the tendency to effectively structure the contents to be addressed and tolerate various levels of cognitive responsibility. Another common response on reasons while men are not using male contraceptive was that contraceptive choices are limited in number for men unlike women who have several alternatives. They believed that one of the two choices for men (vasectomy) can affect sexual performance and even their wives do not encourage them to use the method. The other also does not make couples to have enjoyable sex (condom). They said their wives often complain that they don't enjoy sex when they use condom and that condom does not allow male semen to drop into their vaginal at climax. As an example, one of the participants said;

"We have only two methods of contraception from the health facility which is vasectomy and condom while vasectomy lasts until death. As for me, I cannot do vasectomy because if something happen to my children or wife, I would not be able to give birth to any child and nobody knows tomorrow. However, women have many short term methods such as injections, pills, Implant, and so on which they can use but my wife prefers using injectable without my approval" (Femi, 32 years)

Another respondent also said that;

"Men have no modern contraceptive injection, but we are afraid of what we have for modern contraceptive method like vasectomy which is equal to castration. We only have two methods which means if we don't use a condom, then we have to go for vasectomy which is why I prefer using condom rather than to go for vasectomy." (Husband, 40 years)

Some of the respondents mentioned that they would not allow their wives to do family planning because of promiscuity. In traditional Africa culture, having child for another man when a woman is in marriage is seen as a taboo and such women are often stigmatized in the community. The men in their discussion believed that once a woman is contracepting, she can begin to have sexual affair with other men since she knows that she would not be pregnant. Also they suggested that if options for men can be modified in some ways, they would prefer to use contraceptive instead of their wives.

"If we had something that we would use attach somewhere to space children rather than those two methods you mentioned, then we would directly get involved in Family Planning to avoid giving birth to too many children. I can only use condom which I know that is available for us but the other one you are talking about I have not heard about it. Even though I knew about the injectable and pill, I cannot allow my wife to use it because most women that are using it have another partner outside their matrimonial home which I also believed." (Husband, 37 years)

"Most men have a negative attitude towards issue of modern contraceptives. We believed that they are bad, and also encourage women to move out with other men" (Husband, 25 years)

Questions were asked to identify factors that do hinder men from involving in Family Planning uptake either as individual or as family. Most of the men seem to have common factors as hindrances to their involvement in Family Planning uptake. They mentioned; perceived side effects, lack of sexual pleasure, contraceptive often leads to infertility among men and women, lack of time to follow their wives to the clinic since they are the breadwinner of the family, lack of financial capacity to manage complications as a result of family planning and some see Family Planning matters as women business. These factors were adequately captured in the participants' views as stated below;

"I have been frustrated by several observed side effects, most notably irregular and prolonged bleeding, as well as vaginal dryness, and decreases in sex drive. I encourage my wife to go to Family Planning Clinic so that they will counsel her about different methods of modern contraceptive use, but she is not ready to do family planning again because of her previous experience" (Husband, 45 years)

"Men are not fully involved in Family Planning and promotion of contraceptive use because they do not know. It is common for women to be sensitized because they go for antenatal care, but men do not go for antenatal care. There are only few who go there with their wives. At our area, there are no sensitizations targeting men. It is only a few women who educate their men about the use of contraceptive, and they can't really explain to them very well". (Husband, 41 years)

"They over bleed throughout, so as men, when you find her over bleeding, you choose to go out for other women. So, we want you to give us some advice because even going for vasectomy has a problem." (Husband, 33 years)

"If you have a wife that use pills, these pills have some side effects on those women like dizziness, nausea and bleeding. Like me now, am a farmer, so when my wife goes to farm, she returns late without any work done and complaining of sickness. If your wife has no side effects in using Family Planning pills then it is okay. But the problem is that my wife asked for money from me because she was sick and needed treatment for the side effects which I don't like." (Husband, 39 years)

Voice of the service providers

The role of service providers traditionally included those activities that assist the client in choosing the

right method, provision of counselling and management of complications resulted after contraceptive uptake. The family service providers at the health facilities located in the study area also shared their experience.

"A commonly reported factor among married men to support their partner's use of contraceptive methods related to perceived side effects which were blamed for reducing sexual pleasure and increasing women's risks of infertility and illness. Majority of men were not available to follow their wife to Family Planning Clinic due to their work. Also, among the available ones, most of them will ignore it and say they don't have time that is women's business not for them, some will even discourage their wife not to go to Family Planning Clinic that what were they teaching them". (Family planning service provider, 40 years)

"Some of the women that come to the clinic often said that they lose their sexual appetite, and no longer want to be with a man and others bleed for all the three months. Sometimes this causes problems in the marriages. Even men claimed that their wives do not have appetite for sex as they used to be before the uptake of contraceptive and at times make them feel as if they do not have a wife. They end up looking for sex outside their marriage". (Family planning service provider, 35 years)

Multivariate analysis

Adequate knowledge of vasectomy

The data as shown in table 3 revealed that the identified predictors of men having adequate knowledge of vasectomy are; place of residence, occupation, income and level of education. The likelihood of having adequate knowledge of vasectomy was lower among men living in the rural (OR=0.39; C.I=0.27-0.59, $p<0.001$) than their counterparts in urban. Also being a professional (OR=3.22; C.I=2.05-5.05, $p<0.001$) or civil servant (OR=2.06; C.I=1.35-3.14, $p<0.01$) promotes adequate knowledge of vasectomy compared to being a trader. Also, there is an evidence of direct relationship between adequate knowledge of vasectomy and income as men who earned at least ₦70,000.00 a month (OR=1.98; C.I=1.10-3.56, $p<0.001$) had higher likelihood of adequate knowledge of vasectomy that those who earned less than ₦10,000.00 a month. Men who had attained higher level of education were 2.70(C.I=1.84-3.94, $p<0.001$) times more likely to have adequate knowledge of vasectomy than those with at most primary education.

Table 3: Logistic regression of factors influencing adequate knowledge of vasectomy

Background Characteristics	Knowledge of Vasectomy Odd Ratio	95.0% C.I
Age		
<30 *(R.C)*	1	
30-39	1.21	0.79-1.83
40-49	1.48	0.94-2.33
50-59	1.31	0.81-2.11
Place of residence		
Urban (R.C)	1	
Rural	0.39*	0.27-0.59
Religion		
Islam (R.C)	1	
Christianity	0.72	0.46-1.12
Traditional	1.53	0.99-2.36
Occupation		
Trading (R.C)	1	
Professional	3.22*	2.05-5.05
Civil servant	2.06**	1.35-3.14
Artisan	1.09	0.64-1.87
Others	1.06	0.60-1.86
Income		
<10000 (R.C)	1	
10000-39999	1.59	0.96-2.63
40000-69999	1.69	0.98-2.88
70000+	1.98*	1.10-3.56
Level of education		
≤Primary (R.C)	1	
Secondary	0.80	0.53-1.19
Higher	2.70*	1.84-3.94

**Significant at 0.1%; **Significant at 1%; ***Significant at 5%; R.C: Reference Category;*

Discussion

Marriage is a social practice which every individual looks up to in south west Nigeria as for other regions in the country. Reasons for marriage are numerous and vary among different ethnic groups in Nigeria. However, one common motive of marriage in any society is procreation and in some circumstances people often stigmatize against childless families. Despite the degree of passion for children in families, high frequency of births has been found to be inimical to maternal and child health particularly in a developing country like Nigeria where poverty ravages the population [5]. Consequently, families are beginning to reduce their family size through the use of modern contraceptives but one of the challenges often reported by wives is lack of support from their husbands[18,19].Involving men in

contraceptive uptake has become a major public health issue because of its associated challenges and barriers.

In this study, the mean age of the men was 38.5±5.2 years. The observed means age of the men is expected as the study focused on married men in stable union. In Nigeria, late marriage is common among men which may be a result of economic harsh condition in the country. Predominantly, men in Nigeria would want to acquire basic necessities of life particularly being gainfully employed before getting married. Unfortunately, these needs are hard to reach; consequently, postponement of marriage becomes inevitable. In a recent national survey conducted in Nigeria, the mean age of married men (15-59 years) was found to be 36.4±7.5 years [2]. Also, almost all the men in the current study had at least primary education with majority (60.0%) having at least secondary education. This is in line with men's educational distribution profile in Nigeria [2,20].

Only 1.3% of the men had been sterilized. This percentage was higher than the national figure [2]. The reason for our finding may be the presence of a tertiary health institution in the study area and the existence of a world class university which may provide health information services as part of their community engagement is another possible reason.

In this study, about one in three men had adequate knowledge of vasectomy. Adequate knowledge of vasectomy was found to be higher among men living in the urban than rural areas. This finding corroborates previous outcomes of similar studies conducted in other countries [21,22]. Men who belong to professionals or civil servants work group had higher proportion of their members having adequate knowledge of vasectomy than traders. Professionals and civil servants may likely have highly educated individuals in their group possibly live in urban areas unlike their counterparts who are traders and this could be a strong reason for this differential. Earning higher income promotes adequate knowledge of vasectomy among the studied men. This is in line with previous study in Nigeria [23]. The likelihood of adequate knowledge of vasectomy was found to be three times more among men in higher education category than those with not more than primary education. The pattern may be explained by the possibility that reproductive health issues are taught at secondary and higher education levels. This outcome is consistent with result from past studies [23,24].

While there are many influential factors, in the past, low contraceptive prevalence has been attributed in part to men's opposition to or non-involvement in Family Planning [25]. During the FGD conducted to explore why some men and their wives are not currently using family planning, numerous reasons were mentioned as being responsible for this behaviour. These include: lack of awareness of specific method, sexual pleasure, fear of side effect (dizziness, nausea and bleeding),limited number of contraceptive choices for men, promiscuity, infertility and lack of time to follow their wives to the clinic. Others are: financial incapacity to manage complications as a result of family planning and some have the perception that family planning matters are women affairs. Some of these factors have been reported in past studies [26-28].

The service providers reported that perceived side effects which can result in reduction of sexual pleasure, increasing women's risks of infertility and illness as often mentioned by men inhibit most men from being involved in family planning. These factors have been reported in other settings [27,28]. The study further revealed that the reason why some men did not follow their wife to family planning clinic was their job and believe that family planning is solely women's business not men. Also, loss of sexual appetite among women and prolong bleeding are the reasons men often gave for discontinuation of family planning. The study further show that sometimes these conditions have tempted some men to seek for sexual relationship outside marriage and they would not want to indulge themselves in such act in the future. These findings suggest that there are numerous reasons why males are not involved in family planning in the study area.

Limitation

Although, the men interviewed reported that they have only one wife and have married only once in their life time. This may not be true as there was no further investigation to validate their claim. As such, some of the participants may not be qualified to be part of this study, but we ensured that such cases were brought to bearable minimum during data collection.

Conclusion

Adequate knowledge of vasectomy was found to be low among married men in Ife Central LGA. The key determinants of adequate knowledge of vasectomy were: place of residence, occupation, income and level of education. This study has identified several barriers to modern contraception. The identified barriers should be considered while

designing strategies that will enhance male involvement in Family planning in Ife Central LGA. Family planning information services should be made available and sustained in the community. There is sufficient evidence from this study to support scaling up of community-based family planning programmes that target married men in the study area.

Authors' contributions

AAS conceptualized the study design and all authors were involved in the development and implementation of the study. AR and GMB coordinated data collection exercise and reported the qualitative arm of the study. AAS carried out the data analyses and drafted the manuscript. All authors revised and approved the final manuscript.

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Day case groin surgeries in children in Ibadan, Nigeria: spectrum of cases, trends over time and role of residents.

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Abstract
Background: Childhood groin lesions are mostly treatable in ambulatory settings. However, in view of inadequate paediatric surgical manpower in developing countries, there is a long waiting time to surgery that may result in untoward sequelae. The aim of this study was to review the spectrum of groin surgeries in a major teaching hospital in Nigeria, evaluate the timing of surgery and assess the cadre of surgeon operators.
Methods; This was a cross-sectional study conducted by retrospectively reviewing the surgical records of patients who had elective groin surgeries in a single unit between January 2003 and December 2014. Data was analysed using SPSS version 21 with $p < 0.05$ considered statistically significant.
Results: A total of 833 patients aged 2 weeks to 15 years (782 males) had 960 elective day case groin surgeries during the period. The groin lesions were inguinal hernia in 427 (51.3%), congenital hydrocele in 250 (30.0%) and undescended testis in 156 (18.7%) patients. May (101, 12.1%) and September (96, 11.5%) recorded the highest monthly averages of groin surgeries. The residents performed 55.8% of orchidopexies and 68.5% of herniotomies ($p = 0.002$). The proportion of surgeries performed by residents increased during the study ($p < 0.001$).
Conclusion: The commonest groin lesion requiring day case surgery in children is inguinal hernia. The highest proportions of groin surgeries are done in May and September at the beginning of school terms. The residents performed 56% of orchidopexies and 69% of herniotomies.

Keywords: *Day case, groin lesions, hydrocele, inguinal hernia, paediatric surgery, undescended testis*

Résumé
Contexte: Les lésions de l'aine à l'enfance sont principalement traitables dans les milieux ambulatoires. Cependant, compte tenu de l'insuffisance de la main-d'œuvre chirurgicale pédiatrique dans les pays en voie de développement, il y a un long temps d'attente pour intervention chirurgicale qui peut entraîner des séquelles désastreuses. L'objectif de cette étude était d'examiner le spectre des chirurgies de l'aine dans un majeur hôpital d'enseignement au Nigéria, d'estimer le temps de la chirurgie et d'évaluer le cadre des opérateurs de chirurgie.
Méthodes; Il s'agissait d'une étude transversale menée en examinant rétrospectivement les dossiers chirurgicaux des patients qui avaient des chirurgies électives de l'aine dans une seule unité entre janvier 2003 et décembre 2014. Les données ont été analysées à l'aide de SPSS version 21 avec $p <0,05$ considéré statistiquement significatif.
Résultats: Un total de 833 patients âgés de 2 semaines à 15 ans (782 garçons) ont eu 960 cas de chirurgies électives d'un jour de l'aine pendant la période. Les lésions de l'aine étaient la hernie inguinale chez 427 (51,3%), l'hydrocèle congénitale chez 250 (30,0%) et les testicules non descendus chez 156 patients (18,7%). Mai (101, 12,1%) et Septembre (96, 11,5%) ont enregistré les moyennes mensuelles les plus élevées des chirurgies de l'aine. Les résidents ont effectué 55,8% d'orchidopexies et 68,5% d'herniotomies ($p = 0,002$). La proportion de chirurgies effectuées par les résidents a augmenté au cours de l'étude ($p <0,001$).
Conclusion: La lésion de l'aine la plus commune nécessitant un cas de chirurgie d'un jour chez les enfants est la hernie inguinale. Les plus grandes proportions de chirurgies de l'aine sont effectuées en mai et septembre au début des trimestres scolaires. Les résidents ont effectué 56% des orchidopexies et 69% des herniotomies.

Mots clés: *cas du jour, lésions de l'aine, hydrocèle, hernie inguinale, chirurgie pédiatrique, testicules non descendus*

Introduction

Groin surgeries are among the most commonly performed elective procedures in children [1]. The most prevalent groin lesions that require surgery are inguinal hernias, hydroceles and undescended testes [2,3]. Less common lesions that are operated on elective basis include femoral hernias, inguinal lymph node enlargements and cystic lymphangiomas

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[2]. Groin surgeries are short procedures that are done under general anaesthesia, mostly with inhalational agents in paediatric surgical practice; hence most children with groin lesions can be operated on an ambulatory basis [4].

In view of the highly prevalent nature of these lesions and an inadequate paediatric surgical workforce, many paediatric surgical centres in Africa have a somewhat long waiting list [5-7]. Unfortunately, prolonging the interval between observation of a groin bulge and timing of surgery increases the likelihood of incarceration in inguinal hernia and may adversely affect the outcome of orchidopexy for undescended testis [8,9]. Compounding this is the wish of parents to have elective surgery for their children done at a time that one of them would be free from work [8] and also not lead to the child missing days at school. The time of the year that most of these elective groin surgeries are performed has, however, not been documented. Such information would be helpful in planning elective surgical lists and manpower needs by paediatric surgical units.

Furthermore, surgical registrars training in the West African sub-region require some degree of proficiency in paediatric surgery in view of the broad spectrum of congenital and acquired diseases encountered, the benefits of exposure to short cases that abound and the fact that most of the member countries have about 50% of their population being children and adolescents [10]. Additionally, it is an opportunity for senior residents to become more adept at performing rather delicate surgery in children in preparation for involvement in more complex surgical operations. Surgeons use groin surgeries, such as hernia repairs, to reinforce the process of teaching, training and mentoring of junior colleagues in the art and practice of surgery since the procedures are rather straight forward, of short duration and with minimal postoperative challenges.

The aim of this study was to review the spectrum of cases of ambulatory groin surgeries in a major tertiary hospital in Nigeria, evaluate the trends in the timing of surgery and assess the cadre of surgeons performing the procedures over time. The findings may influence our practice going forward from here as well as that of other surgeons.

Materials and methods

This was a cross-sectional study conducted by retrospectively reviewing the surgical records of patients who had open groin surgeries in the Division of Paediatric Surgery, University College Hospital, Ibadan between January 2003 and December 2014. Information was obtained on the socio-demographic details of the patients, the presenting complaints, diagnosis and side of lesion as well as associated conditions. Also recorded were the procedure performed, date of surgery, cadre of surgeon, the length of stay in the post anaesthesia care unit, outcome of treatment and details of follow up. Patients who had laparoscopy assisted groin surgeries, emergency surgery for incarcerated inguinal hernia or acute scrotum and those who had groin surgeries as secondary operations where the primary surgeries were not on the groin were excluded from the study.

Data were computed and statistical analysis performed using SPSS for windows version 21 software (IBM Corp, 2012, Armonk, NY). Descriptive variables were presented using proportions and percentages or medians and ranges as appropriate. Cross tabulation was done and bivariate analysis performed using Chi square statistics to test for associations between categorical variables – with groups compared based on diagnosis and side of lesion. The p value for statistical significance was < 0.05.

Results

A total of 833 patients had 960 groin surgeries as elective day case procedures during the period of the study with 782 (93.9%) males and 51 (6.1%) females with a male to female ratio of 15.3:1. The age of the patients ranged from 2 weeks to 15 years with a median age of 3 years. The right groin was operated in 400 (48.0%), the left in 306 (36.7%) and both sides in 127 (15.3%) patients. The diagnosis included: inguinal hernia in 427 (51.3%), congenital hydrocele in 250 (30.0%) and undescended testis in 156 (18.7%) patients. A hernia co-existed with the undescended testis in 20/156 (12.8%) patients and a hydrocele was present in 10/427 (2.3%) patients with a hernia. The right side was more commonly involved in patients with groin hernias, hydroceles or undescended testes, $p < 0.001$ (Table 1).

The number of groin surgeries performed each year ranged from 22 in 2009 to 110 in 2011 (Figure 1). The monthly averages of groin surgeries performed ranged from 46 in February to 101 in May (Figure 2); the highest volumes of cases were operated in May (101, 12.1%) and September (96, 11.5%).

A total of 551 (66.1%) patients had their surgeries performed by residents – the remaining 282 (33.9%) were done by consultants; the proportion of cases performed by residents included 55.8% of orchidopexies for undescended testes and 68.5% of herniotomies for inguinal hernias and congenital hydrocoeles ($X^2 = 9.231$, $p = 0.002$). The proportion

Table 1: Distribution of lesions in relation to affected groin

Diagnosis	Side of the groin involved Right No (%)	 Left No (%)	 Bilateral No (%)	 Total No (%)	X^2	p value
Inguinal hernia	223 (52.2)	141 (33.0)	63 (14.8)	427 (100.0)	28.887	< 0.001*
Hydrocele	115 (46.0)	112 (44.8)	23 (9.2)	250 (100.0)		
Undescended testicles	62 (39.7)	53 (34.0)	41 (26.3)	156 (100.0)		
Total	400 (48.0)	306 (36.7)	127 (15.2)	833 (100.0)		

* – Statistically significant

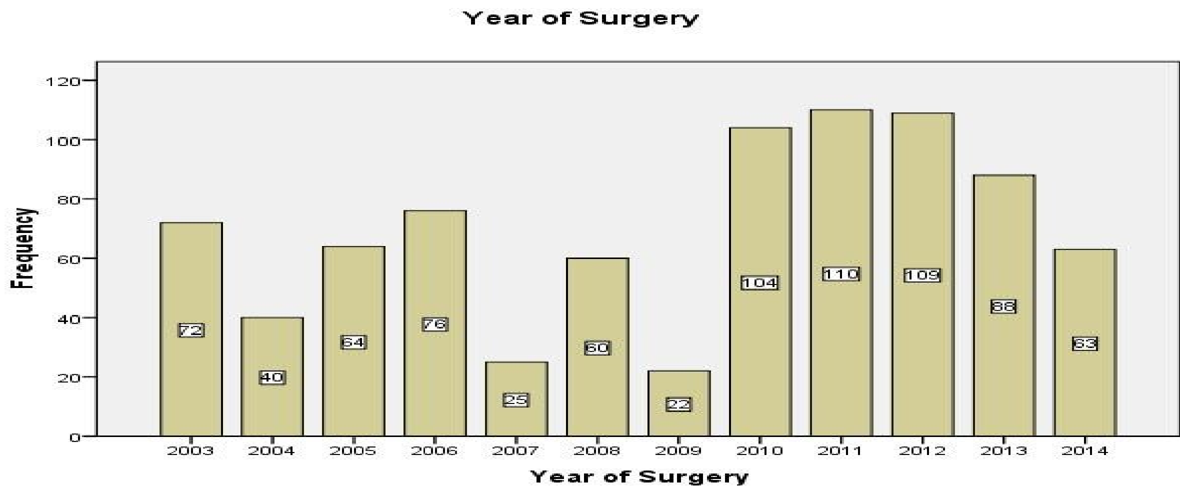

Fig. 1: The number of groin surgeries performed each year during the study (Industrial actions occurred over prolonged periods in 2009, 2013 and 2014)

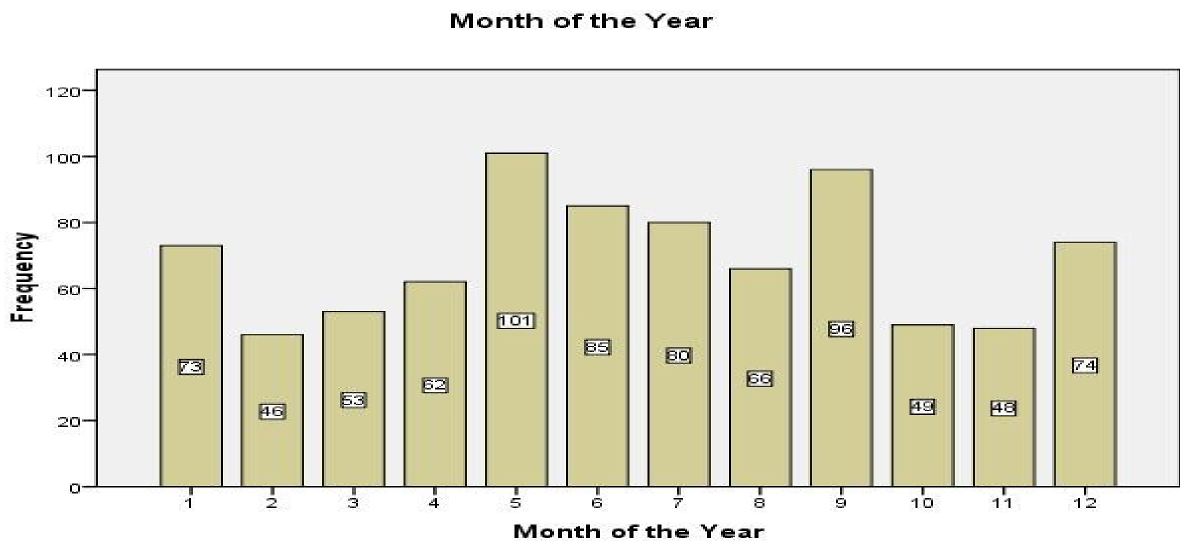

Fig.2: Monthly distribution of the groin surgeries performed (Months 1 to 12 = January to December in sequence)

of surgeries performed by residents over block periods of four years ranged from 51.7% between 2007 and 2010, through 62.3% between 2003 and 2006 to 77.0% between 2011 and 2014 ($p < 0.001$).

The patients were observed on the ward designated as the post anaesthesia care unit for day cases for 2 hours to 8 hours, median of 4 hours except in 12 (1.4%) patients who were admitted for overnight stays in the hospital. Four of these 12 had sickle cell anaemia and were admitted electively for parenteral analgesia and prolonged oxygenation to prevent hypoxia; five were neonates who had bilateral groin surgeries and three patients were admitted on account of poor recovery from anaesthesia. There was no readmission from home and no mortality was recorded. Only one patient had a procedure related morbidity of recurrence of hernia, which necessitated reoperation. The length of follow up ranged from 2 weeks to 5 years with a median duration of 6 months.

Discussion

This study is a review of groin surgeries performed on an ambulatory basis in a single paediatric surgical unit in a major referral hospital in South Western Nigeria. Nearly 1000 procedures were carried out safely over the study period with no record of mortality and with minimal procedure related morbidities. Inguinal hernias accounted for over half of cases that were operated and thus the most commonly encountered groin lesion in children. Abantanga [2] had previously shown that over 70% of children with groin swelling who had elective surgery in Kumasi, Ghana presented on account of inguinal hernias. Similarly, Abdur-Rahman *et al* [1] had reported from Ilorin, Nigeria that 71% of 449 children that had day case surgery in their hospital were operated based on a diagnosis of inguinal hernia or hydrocele. This implies that inguinal hernia, congenital hydroceles and undescended testis – all being minor congenital malformations continue to dominate the elective day case lists of paediatric surgeons in similar settings.

No case of femoral hernia was seen in children in the hospital during the period, confirming the rarity of such as documented in studies from similar settings as ours [1]. Inguinal lymph node excisions that had been reported by others [2] as often encountered were not reported in the present study; majorly because those were done either in the treatment room on the wards for in-patients or in the minor procedure theatre in the surgical outpatients clinic in the hospital hence were not captured in this series.

The number of cases seen each year varied quite widely from as low as 22 to as much as 110 in a year. The yearly variation is not unlikely to be related to the extent of industrial actions that affected service delivery at the hospital, which were more intense over some years than others while 2011 was relatively free of such events. The monthly distribution of groin surgeries performed as day cases showed a preponderance of cases in May and September and the least number of procedures were done in February, October and November. May and September represent the beginning of the school term, third and first terms in schools in Nigeria respectively, when academic work is likely to be less strenuous and vigorous than the middle/end of the term while February and October/November are in the middle of the second and first term of school. December/January that is at the end of the first term holidays and beginning of the second term also recorded good number of cases performed. The study thus confirms that parents and guardians either actively or passively preferentially bring their children for elective day case groin surgery at the beginning of school terms. This is probably because of the reduction in school activities that are missed as well as fewer challenges in caring for a child who is convalescing and does not need to go to school a few days or weeks afterwards compared to one who had surgery during the busier part of the school year. Work and scheduling conflicts have been noted to influence the choice of patients in selecting the timing of surgery [11,12]. Arising from the findings of the present study, the paediatric surgical workforce in Nigeria and other developing countries with similar socio-cultural settings as the study site can modify operative schedules and perhaps increase their elective lists during the months of May and September to reduce the long waiting time for elective groin surgery.

The unplanned admission rate in this study was 1.4%, notably in patients with sickle cell disease and among neonates. Elebute *et al* [13] in a teaching hospital and Calder *et al* [14] in a district general hospital had also reported a 1% – 1.4% unplanned admission rate. Neonates are more prone to development of respiratory distress and have airway obstruction during recovery from anaesthesia when compared to older children [15]. On the other hand, hernias are more likely to undergo obstruction in neonates and infants [16], hence delaying herniotomy in them is not recommended. Further studies are required to evaluate the subset of neonates requiring groin surgery to determine factors that may predict unplanned admission.

Residents performed two-thirds of procedures carried out in this study. This proportion is lower than 90% reported from Idi-Araba, Lagos in a study on day case procedures in 381 children [13]. The lower figure in our series may be due to the exclusion of circumcisions from the study whereas the study conducted in Lagos included those, which accounted for nearly one-sixth of the surgeries done. The residents perform circumcisions in our hospital in most instances. The proportion of cases performed by the residents in this study was inversely proportional to the complexity of the surgery; they performed 56% of orchidopexies, which tend to be the more complex, compared to 69% of herniotomies in this study. Orchidopexy is the most challenging groin surgery for residents and over 50% of graduates completing an accredited general surgery residency programme in the United States were not comfortable with performing the procedure [17]. Furthermore, orchidopexy in addition to oesophagectomy and adrenalectomy were the only surgical procedures in the logbook of the graduates in which surgical volume correlated significantly with proficiency of the trainees [17].

The residents over time performed greater proportion of groin surgeries in the present study. At the beginning of the study period, residents did 62% of the procedures whereas they did 77% of the groin surgeries in the last four years. This significant increase in the proportion of cases performed by the residents occurred in spite of a progressive increase in the consultant staff strength of the division from one to three. It would thus be expedient to say that day case groin surgery is a veritable procedure for surgical residents to be trained to become more involved in surgical operations. The surgical volume of trainees is a determinant of proficiency in performance of surgical operations [18,19]. Surgical training regulatory bodies such as the Accreditation Council on Graduate Medical Education in the United States, while recognizing that surgical training is largely done in an experiential model, has recommended minimum volumes of surgical procedures required to attain proficiency [20]. Similar concepts underlie the recommendations of the West African College of Surgeons and the National Postgraduate Medical College of Nigeria on training of residents in surgery.

In conclusion, the commonest groin lesion requiring day case surgery in children is inguinal hernia. The highest proportions of groin surgeries are done in May and September at the beginning of school terms. The residents performed 56% of orchidopexies and 69% of herniotomies.

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Congenital craniofacial anomalies: The experience of a sub-Saharan African tertiary hospital.

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Abstract

Background: Congenital craniofacial anomalies range from a simple notch to grotesque craniofacial morphology, which may not be compatible with life. There is dearth of literature on the clinical profile of congenital craniofacial anomalies as an entity in our practice setting in sub-Saharan Africa.

Methods: This study retrospectively analyzed the in-hospital clinical records of individuals with craniofacial anomalies during a five-year period in a foremost university teaching hospital in Nigeria. The information retrieved included the biodata of patients and their parents; the types of cranial-facial anomalies whether isolated or associated with other-system birth defects in each case, treatment received, and the final in-hospital disposition – whether dead or discharged home alive.

Results: There were 200 patients with 272 individual craniofacial anomalies constituting 17.4% of all congenital anomalies in our multidisciplinary birth defect study group database. The median age of presentation was 1.7 months; the craniofacial anomalies occurred in isolation in 77.0% of the cases, and craniofacial clefts were the commonest. The cardiovascular, central nervous and musculoskeletal systems were the most common associated with other-system anomalies. The hospital exit status was good in 96% of those with isolated anomalies compared to the 83% in those with concurrent multiple lesions. Surgical treatment was carried out in 56% of the patients with craniofacial anomalies during the study period.

Conclusion: Craniofacial congenital anomalies represented a substantial proportion of all congenital anomalies seen at our centre. Orofacial clefts were the commonest of these anomalies, majority occurring in isolation and significant proportions of these were amendable to surgical operative intervention.

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Keywords: *Craniofacial, congenital, anomalies, multidisciplinary, in-hospital profile, developing countries*

Résumé

Contexte: Les anomalies craniofaciales congénitales vont d'une entaille simple à une morphologie craniofaciale grotesque, qui peut ne pas être compatible avec la vie. Il existe une pénurie de littérature sur le profil clinique des anomalies craniofaciales congénitales en tant qu'entité dans notre milieu de pratique en Afrique subsaharienne.

Méthodes: Cette étude a rétrospectivement analysé les dossiers cliniques hospitaliers de personnes atteintes d'anomalies craniofaciales pendant une période de cinq ans dans un important hôpital d'enseignement universitaire au Nigéria. Les informations recueillies comprenaient les données biographiques des patients et de leurs parents; les types d'anomalies cranio-faciales isolées ou associées à d'autres anomalies congénitales dans chaque cas, le traitement reçu et la disposition finale dans l'hôpital - qu'ils soient morts ou déchargés chez eux en vie.

Résultats: il y avait 200 patients avec 272 anomalies craniofaciales individuelles constituant 17,4% de toutes les anomalies congénitales dans notre base de données multidisciplinaire de groupe d'étude sur les anomalies de naissance. L'âge médian de présentation était de 1,7 mois; Les anomalies craniofaciales se sont produites isolément dans 77,0% des cas, et les fentes craniofaciales étaient les plus fréquentes. Les systèmes cardiovasculaires, nerveux central et musculo-squelette étaient les anomalies les plus fréquentes associées à d'autres systèmes. Le statut de sortie de l'hôpital était bon chez 96% de ceux atteints d'anomalies isolées comparativement à 83% chez ceux atteints de lésions multiples simultanées. Le traitement chirurgical a été effectué chez 56% des patients atteints d'anomalies craniofaciales pendant la période d'étude.

Conclusion: Les anomalies congénitales craniofaciales représentaient une proportion importante de toutes les anomalies congénitales observées dans notre centre. Les fissures orofaciales étaient les plus fréquentes de ces anomalies, la majorité s'étant isolée et des proportions importantes de celles-ci étaient modifiables pour l'intervention chirurgicale.

Mots-clés: *Craniofacial, congénital, anomalies, multidisciplinaire, profil hospitalier, pays en voie de développement*

Introduction

Congenital craniofacial anomalies are abnormalities of structure and/function that involve the cranium as well as the soft tissues and bones of the face. They include defects like cleft lip, cleft lip and palate, cleft palate, atypical facial clefts, eyelid defects, craniosynostosis, first and second branchial arch defects, mandibular defects and oral defects [1-3]. Their severity ranges from minor affectations such as alopetic defect in the eyebrow, minor notching of the upper eyelid, labial pits, bifid uvula, to grotesque craniofacial disfigurements and anencephalic conditions, which may not be compatible with life [4,5].

Orofacial clefts, have worldwide prevalence rates of between 1 in 700 and 4 in 1000 births with racial and ethnic variations [6-8]. Generally, the prevalence is highest in Asian population (2.4 per 1000 births) followed by the Caucasians, (0.91 to 2.69 per 1000 births) and appears to be lowest in native Africans [6-10]. It is, however, not clear if these differences are the results of under-reporting in the less developed countries. This possibility is buttressed by the general lack of functional and dynamic birth registries in these developing populations. It has also been attributed to the non-uniformity in the classification of craniofacial clefts by different studies [6].

Cleft lip and/palate are the commonest craniofacial clefts reported in global literature [6]. They occur in isolation in about 70% of cases or as components of recognized congenital syndromes such as Van der Woude, Pierre Robins and Treacher Collins [6].

The burden of these anomalies is especially not well documented in developing countries. In an effort to investigate and possibly manage these anomalies the need for a dynamic surveillance programme is imperative. However, a baseline data is an integral requirement for setting up a surveillance programme [11]. Thus, it is the aim of this study to provide a multi-disciplinary baseline data for congenital craniofacial anomalies from the premier university teaching hospital in Nigeria.

Materials and methods

This study was a five-year cross-sectional review of cases seen between January 2009 and December 2013 at the University College Hospital, Ibadan, Nigeria. Patients with major structural congenital craniofacial anomalies managed in this hospital over the study period were included. Cases of congenital craniofacial anomalies were extracted from a larger pool of the multidisciplinary data-set of our institution's birth defect study group. These birth defect data-sets were from the hospital's paper-based records. Congenital craniofacial anomaly was defined as any structural craniofacial abnormality present at birth. They were recruited from the records of the managing specialty units including the paediatric surgery, neurosurgery and the orofacial cleft units. Congenital craniofacial anomalies were grouped into five broad types: craniofacial clefts, congenital hydrocephalus, encephalocoele, craniosynostosis and microcephaly. Craniofacial clefts consisted of four subtypes namely; cleft lip alone, cleft palate alone, cleft lip and palate and rare craniofacial clefts.

Case notes were retrieved and patients' data were extracted and managed via an initial dual data entry using epidata version 3.1 and analyzed with IBM® SPSS version 21. Duplicate entry of patient information into the database was prevented using the SPSS software to detect identical hospital numbers and names. Information on biodata, types of craniofacial anomalies, associated anomalies, surgical intervention and hospital exit status was obtained using a proforma on birth defects predesigned to record the targeted study variables. Hospital exit status was determined by the condition of the patients at the time of discharge (discharged alive, dead, and discharged against medical advice - DAMA). Discharged-alive was considered a satisfactory hospital exit status while dead or DAMA was considered unsatisfactory.

The Chi-square test was used to determine the effect of categorical variables such as surgical intervention, gender distribution and occurrence of multiple associated anomalies on hospital exit status. The level of statistical significance was placed at $p<0.05$.

Results

A total of 200 patients presented with 272 congenital craniofacial anomalies over the 5-year period reviewed. These craniofacial anomalies represented

Table 1: Biodata of patients with congenital craniofacial anomalies

Patient age			
•Mean = 18.2 months (SD+/-48.3)			
•<1 year - 152 (76.0%)		Median = 1.7 months	Age range = 1 hour to 35 years
•1 – 10 years – 40 (20.0%)			
•>10 years – 8 (4.0%)			
Gender distribution	Male – 89 (44.5%)	Female – 100 (50.0%)	
Mothers' age	Mean = 31.9 years (SD+/-6.2)	Median = 31 years	Age range= 19 – 52 years

Table 2: Table of Craniofacial anomalies

Anomalies (No. of patients)	Gender M=Male F=Female	Number with Isolated anomaly (%)	Number with more than 1 anomaly(%)	Surgery (%)	Outcome (%)
Cleft lip alone (74)	M = 33 F = 41	71 (95.9)	3 (4.1)	Y= 45 (60.8)* N= 28 (37.8)	Discharged= 73 (98.6)* DAMA= 0 Died= 0
Cleft palate alone (25)	M =10 F = 15	23 (92.0)	2 (8.0)	Y= 12 (48.0)* N= 11 (44.0)	Discharged= 24 (96.0)* DAMA= 0 Died= 0
Cleft lip and palate (16)	M = 7* F = 8	11 (68.8)	5 (31.3)	Y= 10 (62.5)* N= 5 (31.3)	Discharged = 14 (87.5) DAMA= 2 (12.5) Died= 0
Rare craniofacial clefts (4)	M = 3 F = 1	1 (25.0)	3 (75.0)	Y= 2 (50.0) N= 2 (50.0)	Discharged = 2* DAMA=0 Died=0
Hydrocephalus (60)	M = 28* F = 23	47 (78.3)	13 (21.7)	Y= 35* N= 19	Discharged = 46* DAMA= 3 Died= 3
Cranial encephalocoele (8)	M = 3 F = 5	6 (75.0)	2 (25.0)	Y= 7* N=0	Discharged =6 DAMA=1 Died=1
Craniosynostosis (3)	M = 2 F = 1	3	0	Y= 0 N= 3	Discharged = 2* DAMA=0 Died=0
Microcephaly (14)	M =5* F = 8	3 (21.4)	11 (78.6)	Y=4* N=9	Discharged =9* DAMA=3 Died= 0

* Do not add up because of missing data.

17.4% of all birth defects encountered at the hospital during the period. There were 89 males and the mean age was 18.2 months. Their biodata are as presented in table 1. Craniofacial clefts accounted for the majority of the cases while the craniosynostosis was the least common (Table 2). Isolated craniofacial anomaly occurred in 77.0 % of the cases. Microcephaly had the highest proportion of associated other-system anomalies (Table 2). The associated anomalies were found in similar proportions in the cardiovascular system, central nervous system, orbital region, and musculoskeletal system. The details of the other-system anomalies are as shown in table 3.

Fifty-six percent of the patients had surgical intervention for their anomalies; 87.0% were discharged alive; 2.0% died and 4.5% obtained discharge against medical advice. For the purpose of statistical analysis, the 'Type of craniofacial anomaly' was re-categorized as craniofacial clefts and other craniofacial anomalies (Table 4). The craniofacial cleft group all had satisfactory in-hospital outcome while about a seventh of the other

Table 3: Types and frequency of associated other system anomalies

	CVS	GIT	CNS	EG	GUT	MSS	CI	Eye	ENT	AAWD	V
Cleft lip anomaly 74	1- VSD	_	1-H	1-DS	-	1-A	-	-	-	-	-
Cleft palate anomaly 25	1- VSD	-	-	1-DS	1-UT	-	-	1-WG	-	-	-
Cleft lip and palate anomaly16	1- VSD	-	1-M	-	-	1-P 1-HT	-	1-OA	-	1-OMP	-
Rare clefts 4	1- VSD	-	1-CE	1-PS	1- Hp	-	-	-	1-AA	-	-
Hydrocephalus 60	1- VSD	1-CL	7-SB 1-CE	-	1-Hp 1-UT	3-T 1-S	-	-	-	1-IH	1- CH
Microcephaly 14	4-VSD 2-PDA	1-CLP	1-SB	1-DS	2-KM 1-Hp 1-UT	1-T 2-P	5-CRS	6-CA 1-WG 1-CO	1-M	1-IH	-
Cranial encephalocoele 8	-	1- RC	-	1-PS	-	-	-	-	-	-	-
Total 204	11	3	11	5	7	11	5	10	2	3	1

RT- Respiratory tract, CVS- Cardiovascular system, CNS- Central nervous system, EG- Endocrine/Genetic, GUT-Genitourinary tract, MSS- Musculoskeletal system, CI-Congenital infections, ENT-Ear Nose and Throat, AAWD- Anterior abdominal wall defect, V- Vascular, CL- Cleft lip, CP- Cleft palate, CLP-Cleft lip and palate, VSD Ventricular sepatal defect, PDA-Patent ductus arteriosus, DS- Down syndrome, PS-Patau syndrome, UT-Undescended testes, CE- Cranial encephalocoele, H- Hydrocephalus, M-Microcephaly, SB- Spina bifida, RC-Rare craniofacial clefts, Hp-Hypospadias, KM- Kidney malformation, A- Achondroplasia, P- Polydactyly, HT-Hypoplastic thumb, T- Tallipes, S-Syndactyly, CRS- Congenital rubella syndrome, WG- Whole globe abnormalities, OA- Orbital abnormalities, CA- Cataract, CO- Congenital corneal opacity, AA- Aural atresia, M- Microtia, OMP- omphalocoele, IH- Inguinal hernia, CH- Cystic hygroma.

Table 4: Table of associations

		Hospital Exit Status			
		Discharged (%)	Dead (%)	DAMA (%)	p-value
Type of craniofacial anomaly	Craniofacial clefts	100 (100.0)	0 (0.0)	0 (0.0)	<0.005
	Other craniofacial anomalies	60 (84.5)	4 (5.6)	7 (9.9)	
Gender	Male	76 (95.0)	2 (2.5)	2 (2.5)	0.099
	Female	88 (93.6)	0 (0.0)	6 (6.4)	
Number of anomalies	Single	149 (95.5)	4 (2.6)	3 (1.9)	0.005
	Multiple	24 (82.8)	0 (0.0)	5 (17.2)	

Note:
Craniofacial clefts = cleft lip alone + cleft palate alone + cleft lip and palate +other craniofacial clefts
Other craniofacial anomalies = congenital hydrocephalus + microcephaly + cranial encephalocoele + craniosynostosis

craniofacial anomalies (15.5%) had unsatisfactory in-hospital outcome. In addition, only a minority (4.5%) of the patients with isolated (single) anomaly had unsatisfactory hospital exit status while 17.2% of patients with multiple anomalies had unsatisfactory hospital exit status, majority being discharged against medical advice. The difference was statistically significant (Table 4).

Discussion

Craniofacial anomalies are a varied group of birth defects seldom reported as a whole. In the literature, the term 'craniofacial anomalies' is often used mainly in reference to craniofacial clefts. Sometimes, however, it is also used to capture cases of congenital hydrocephalus, craniosynostosis, and encephalocoele which occur either in isolation or as components of neural tube defects (NTDs), and which may not be limited to the craniofacial region [12,13]. It was therefore difficult to compare the prevalence rate in this study to most reports in the literature. In this study, the prevalence rate is 17.4% which is slightly lower than previous African reports of 20.8% and 24.5% in Nigeria and Abidjan respectively [14,15].

Craniofacial clefts were the commonest craniofacial anomalies observed in this study. This is similar to findings previously documented by other studies [2, 3,16-18]. Cleft of the lip alone (CL) and cleft of the lip and palate (CLP) have been considered to be variants of the same entity but of varying severity [8]. Therefore, they are generally referred to as cleft of the lip and/or palate (CL/P). However, there is yet other evidence that CL and CLP may not be variants of same entity, as attempts have been made to demonstrate the differences between these two anomalies and there are publications that reported them separately [3,7,18,19]. They are therefore considered separately in this study for the purpose of clarity. Cleft Lip was the most common of all craniofacial anomalies as well as among all craniofacial clefts. Contradictory reports of the type of craniofacial clefts with the highest frequency exist in the literature. From their study, Kesande *et al* reported CL as the commonest while others like Aziza *et al* reported CP as the commonest [3,7]. Craniosynostosis, which has been reported as one of the commonest of the cranial anomalies occurring as 1 in 2,000 to 2,500 live births was the least represented in our series [3-20]. Anencephaly and spina bifida are regarded as the most common of the neural tube defects [5]. No case of anencephaly was recorded in our study. The retrospective nature of our study as well as the ward admission-based acquisition of the data from the neurosurgical unit may account for these observed dissimilarities with literature reports since cases of craniosynostosis not admitted on the wards were not captured in our data. The lack of anencephalic cases (a condition that is not compatible with life) may be due to the unavailability of stillbirth records in our centre during the period of this study.

In our study, the maternal age range was 25 to 35 years, a very young maternal population indeed. This was similar to the findings of Onankpa in Sokoto in Nigeria and Kesande in Uganda who reported maternal mean age of 26 years and 55.0% of the mothers younger than 30 years respectively [7,14].

Craniofacial anomalies, especially orofacial clefts, have been reported to be more common in males than females [3,7]. While CL/P is said to be

more prevalent in males, CP is commoner in females in some studies; still, other reports revealed no gender difference [8,16,19,21-23]. Very few studies have reported female preponderance for CL/P [6,7]. In our study, there were more females than males with craniofacial anomalies. The authors do not know the reason for this, apart from the possible bias of the retrospective nature of this analysis.

Our study revealed that the occurrence of both non-cleft congenital craniofacial anomaly and multiple congenital anomalies both significantly predict an unsatisfactory in-hospital outcome (Table 4). The reason for the poor outcome needs to be investigated; however, financial constraints, poor health facilities and lack of expertise to manage these complicated cases are possible reasons.

Distinguishing between the isolated and multiple anomaly cases may shed some light on the nature of aetiology of these anomalies [2]. In this study majority of the craniofacial clefts occurred as isolated clefts. However, the proportion of cases occurring with associated anomalies (10.9%) is, on the one hand, higher than that reported by Butali *et al* [20] who documented a rate of 4.7%; and, on the other hand, lower than 30% reported by the WHO registry on craniofacial anomalies, as well as the 18% and 50% reported in some other studies [3,24]. The CLP was the most occurring craniofacial cleft with associated anomalies. This is similar to the report of Jugessur *et al* [18] in Norway but differs from the documentation of Marazita [7], which stated that CP alone has a higher percentage of associated anomalies [7,18]. The cardiovascular system anomaly was the one with the most prevalent association with congenital craniofacial anomalies. This was similar to the findings in literature [2,3].

Increasing number of congenital craniofacial anomalies, especially the craniofacial clefts, are benefitting from surgical correction and therefore finding some sort of solution. Nevertheless, affected patients and their parents or caregivers may have to endure multiple and expensive interventions practically throughout an affected individual's life time with attendant psychological effects. A means of prevention will no doubt be a better and cheaper option. However, for this option to be a reality, these anomalies need to be understood. The first step in understanding them will require collection of representative data, which can be obtained adequately through prospective birth defect surveillance programmes as proposed by WHO in 2010 [25]. This further emphasizes the need to set up birth defect surveillance in our environment and in Africa as a whole [11].

This study demonstrates the benefits of a multidisciplinary approach to research. It is the first of its kind in our centre to look at congenital craniofacial anomalies as a whole as well as their association with other system anomalies. However, this being a retrospective study was challenged by shortcomings such as missing data. A more comprehensive prevalence study will require additional information on prenatal screening, terminated pregnancies and stillbirths in order to appreciate the true magnitude of congenital craniofacial anomalies' burden in our environment and to compare with similar data from the registries of industrialized countries.

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Ophthalmic congenital anomalies: spectrum and systemic associations in a Nigerian tertiary hospital

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Abstract

Background: To document the pattern of ophthalmic congenital anomalies and their associated systemic anomalies in Nigeria's foremost university teaching hospital.

Methods: Retrospective cross-sectional study conducted at the University College Hospital, Ibadan from January 2009 to December 2013. Clinic and ward registers of various departments and units in the hospital were reviewed to identify children with any structural abnormality, present at birth, which involved the eye and/or its adnexae.

Results: Two hundred and forty eight children with 259 ophthalmic congenital anomalies were studied. The median age was 1.2 years with an interquartile range of 4.6 years. The male to female ratio was 1.27:1. Congenital cataract was found in 109 (44%) patients; 40 (15.4%) children had congenital glaucoma, and whole globe anomalies were observed in 18 (6.9%) children. Eighteen (7.9%) children had a family history of congenital anomalies. Associated systemic congenital anomalies were seen in 32 (12.9%) patients with the most common being cardiovascular anomalies in 13 (5.2%) patients. Children who had congenital cataracts were more likely to have multiple associated systemic anomalies ($p<0.005$). All the children who had associated cardiovascular anomalies had congenital cataracts ($p= 0.001$).

Conclusion: The commonest ophthalmic congenital anomaly presenting for tertiary care in Ibadan is congenital cataract. Cardiovascular anomalies are the commonest systemic association of ophthalmic congenital anomalies. There is an urgent need for the establishment of a registry for congenital anomalies with effective screening and active surveillance within the Nigerian health system.

Keywords: *Ophthalmic, congenital, anomalies, surveillance*

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Résumé

Contexte: Pour documenter le profil des anomalies congénitales ophtalmiques et leurs anomalies systémiques associées dans l'hôpital universitaire le plus important du Nigéria.

Méthodes: Une étude rétrospective transversale menée au Collège Hospitalier Universitaire, Ibadan de janvier 2009 à décembre 2013. Les registres des cliniques et des salles de différents départements et unités de l'hôpital ont été examinés afin d'identifier les enfants présentant avec anomalies structurelles quelconques, présentes à la naissance, qui impliquaient l'œil et / ou ses annexes.

Résultats: Deux cent quarante-huit enfants avec 259 anomalies congénitales ophtalmiques ont été étudiés. L'âge médian était de 1,2 an avec un rang interquartile de 4,6 ans. Le rapport homme-femme était de 1,27: 1. La cataracte congénitale a été retrouvée chez 109 patients (44%); 40 (15,4%) enfants avaient un glaucome congénital et des anomalies globales ont été observées chez 18 (6,9%) enfants. Dix-huit (7,9%) enfants avaient des antécédents familiaux d'anomalies congénitales. Des anomalies congénitales systémiques associées ont été observées chez 32 (12,9%) patients avec les plus courantes étant des anomalies cardiovasculaires chez 13 patients (5,2%). Les enfants atteints de cataracte congénitale étaient plus susceptibles d'avoir de multiples anomalies systémiques associées ($p <0,005$). Tous les enfants qui avaient des anomalies cardiovasculaires associées avaient des cataractes congénitales ($p = 0,001$).

Conclusion: L'anomalie congénitale ophtalmique la plus fréquente pour les soins tertiaires à Ibadan est la cataracte congénitale. Les anomalies cardiovasculaires sont les plus fréquentes associations systémiques d'anomalies congénitales ophtalmiques. Il est urgent de créer un registre des anomalies congénitales avec un dépistage efficace et une surveillance active dans le système de santé Nigérian.

Mots-clés: *Ophtalmique, congénitale, anomalies, surveillance*

Introduction

The human eye starts to develop during the third week of intrauterine life from the optic vesicles [1]. Any impairment of this developmental process manifests as ophthalmic congenital anomalies, which range from total absence of the eye (anophthalmos) to less severe anomalies. Some of the latter that are noticed during routine eye examinations as incidental findings may be of no clinical significance to the patient [2]. These congenital eye anomalies are rare and may occur solely, in combination or as components of a craniofacial anomaly, syndrome or a genetic disorder [2-6]. They are varied in nature and can manifest as either an abnormal appearance of the eye or with poor vision. However, their early recognition is of significance in preventing disruption of normal visual development and in enabling the management of preventable childhood blindness. This is currently a global health-care priority [7]. A blind child potentially suffers from many more blind years than a blind adult and since about three quarters of early learning comes from vision, childhood blindness will impact greatly on education and future employment of the affected child [8, 9]. It has also been reported that blind children tend to have a high death rate [7]. Early recognition of ophthalmic congenital anomalies also aids in the diagnosis of an associated systemic disorder or disease, prevention of development of further complications and may contribute to parental counselling [8, 10-13].

Seventy five percent of blind children worldwide live in developing countries where vitamin A deficiency, measles, congenital rubella, cataract and retinopathy of prematurity are the major causes of blindness [7, 14]. However, as vitamin A supplementation and immunizations against measles and rubella are being implemented in developing countries in order to reduce the incidence of blindness in these regions, childhood visual impairment and blindness as a result of other congenital anomalies like congenital cataract, microphthalmos, anophthalmos, coloboma and infantile glaucoma, will become prominent causes of childhood blindness [8, 13, 15].

Globally, the data on the aetiology of childhood blindness vary widely. Structural ophthalmic anomalies have been reported as causes of severe visual impairment and blindness (SVI/BL) ranging from 1.4% to 42.3% of cases [8, 16-18]. Incidence of ophthalmic congenital anomalies in Nigeria is not available due to lack of comprehensive national data. Most of the local studies have been case reports or case series [5, 19, 20]. However, few observational hospital based studies have reported diverse values such as 10.3%, 21.0% and 1.7% as local prevalence of congenital ophthalmic anomalies [12, 21, 22] or a rate of 7 cases per year [23]. Nevertheless, there was no consensus among these local studies on the commonest ophthalmic congenital anomaly as congenital cataract and buphthalmos were reported variously to be the commonest type of congenital ophthalmic anomaly [22-24].

This study was conducted to document the pattern of congenital ophthalmic anomalies and their associated systemic anomalies using data from the largest tertiary hospital in Nigeria as a preliminary baseline for much-needed national data, which will be valuable in the planning of prevention strategies for childhood blindness.

Materials and methods

This was a retrospective cross-sectional study conducted at the University College Hospital, Ibadan, over a five-year period from January 2009 to December 2013.Hospital registers of the following units/departments were reviewed: ophthalmology, neonatology, paediatric neurology, cleft clinic, paediatric surgery, and radiology. Children with congenital ophthalmic anomalies were enrolled into the study. An ophthalmic congenital anomaly was defined as any structural abnormality, present at birth, which involved the eye and/or its adnexae.

Data was retrieved from case notes of patients using a predesigned proforma. Specifically, the following information was obtained: demographic data, type of ophthalmic anomaly and presence of associated systemic anomalies. The records of children who had been seen in more than one unit/department of the hospital were harmonized to avoid duplication of data.

Dual data entry was achieved using Epi Data version 3.1 for ease of data verification and consistency checks. Final data cleaning and analysis was performed using IBM® SPSS version 21.

Results

A total of 248 children were identified to have ophthalmic congenital anomalies during the study period. Their mean age at presentation was 3.9 (± 6.8) years. The median age was 1.2 years with an interquartile range of 4.6 years. One hundred and twenty eight children (51.6%) presented after their first birthdays (Figure 1). The male to female ratio was 1.27:1.

There was a positive history of consanguineous marriage between the parents of one

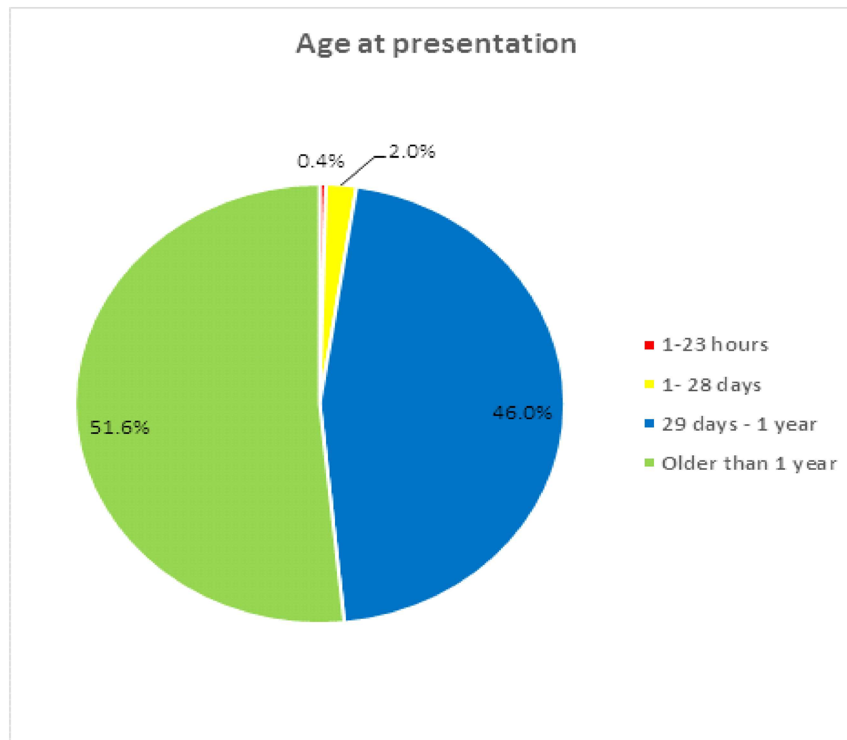

Fig.1: Age at presentation of 248 children with ophthalmic congenital anomalies

(0.4%) of the patients. Ten (4.1%) children were products of multiple gestations. Eighteen (7.9%) children had a positive history of congenital anomalies in the family.

There were a total of 259 ophthalmic congenital anomalies identified among the 248 children. The frequency distribution of the various types of ophthalmic congenital anomalies is presented in table 1. Congenital cataract was the most common, found in 109 (44.0%) patients.

Associated systemic congenital anomalies were observed in 32 (12.9%) patients. Six (2.4%) patients had multiple associated systemic anomalies involving three different systems; five (2.0%) were found to have associated systemic anomalies involving two different systems, and 21(8.5%) had a single associated systemic anomaly.

The systemic classifications and the specific associated congenital anomalies are shown in table

Table 1: Types of ophthalmic congenital anomalies seen in 248 children

Ophthalmic congenital anomalies	Frequency	Percentage (%)
Congenital cataracts	109	42.1
Congenital glaucoma	40	15.4
Microphthalmos / Anopthalmos (Whole globe anomalies)	18	6.9
Aniridia	7	2.7
Congenital corneal opacity	19	7.3
Congenital nasolacrimal duct obstruction	7	2.7
Strabismus	22	8.5
Oculocutaneousalbinism	10	3.9
Retinal abnormalities	4	1.5
Colobomas	2	0.8
Lid abnormalities	3	1.2
Orbital abnormalities	5	1.9
Other corneal abnormalities	2	0.8
Others	11	4.2
Total	259	100%

2. Thirteen (5.2%) patients had associated cardiovascular anomalies.

Children who had congenital cataracts were more likely to have multiple associated systemic anomalies (p<0.005, see Table 3). Furthermore, all the children who had associated cardiovascular anomalies had congenital cataracts (p= 0.001 see Table 4); and all the children with presumed congenital rubella infection also had congenital cataracts (p<0.005, see Table 5). A total of 98 (39.5%) of the children underwent surgical intervention; of which 68 (69.4%) had cataract surgery and 19 (19.4%) patients had surgery for congenital glaucoma.

Discussion

This study collected and analyzed data from a fairly wide variety of sources within one large tertiary hospital in a large sub-Sahara African developing country. This multidisciplinary perspective of the study is likely to have facilitated the recruitment of the majority of the patients that would have presented to any unit of our hospital with any form of ophthalmic congenital anomaly. As a matter of fact, to the best of our knowledge, our study population of 248 patients over 5 years, and that in a hospital-based retrospective study, is the largest to date among previous studies on ophthalmic congenital anomalies in the country.

Table 2: Systemic anomalies associated with ophthalmic congenital anomalies among 248 children

System	Frequency (%)	Specific anomalies (Number of cases)
Cardiovascular system	13(5.2)	VSD* (10), PDA[#](5)†
Central nervous system	6(2.4)	Microcephaly(6)
Craniofacial anomalies	7(2.8)	
Endocrine & genetic system	5(2.0)	Down syndrome(4), Marfan syndrome(1)
Musculoskeletal system	1(0.4)	
Congenital infections	8(3.2)	Presumed Rubella syndrome (8)
Ear, nose and throat	2(0.8)	Congenital auricle defect(1), Hearing loss(1)

**VSD = Ventricular septal defect;*
[#]PDA = Patent ductus arteriosus
† Two patients had a combination of PDA and VSD

Table 3: Association between type of ophthalmic congenital anomaly and occurrence of multiple systemic anomalies

Type of ophthalmic anomaly	Number (%) of associated systemic anomalies				Chi-square	P-value
	None	1	2	3		
Congenital cataracts	85(78.0)	14(12.8)	4(3.7)	6(5.5)		
Congenital glaucoma	39(100.0)	0(0.0)	0(0.0)	0(0.0)		
Whole globe abnormalities	10(62.5)	6(37.5)	0(0.0)	0(0.0)	47.070	<0.005*
Congenital corneal opacity	14(100.0))	0(0.0)	0(0.0)	0(0.0)		
Strabismus	21(95.5)	1(4.5)	0(0.0)	0(0.0)		
Others	47(97.9)	0(0.0)	1(2.1)	0(0.0)		

**Likelihood Ratio Test*

Table 4: Association between occurrence of cardiovascular anomalies and the occurrence of congenital cataracts among patients with ophthalmic congenital anomalies.

Variables	Cardiovascular system		Chi-square	P-value
	No	Yes		
Congenital cataracts				
No	139(100.0)	0(0.0)	17.495	<0.005
Yes	96(88.1)	13(11.9)		

Table 5: Association between occurrence of congenital infections and the occurrence of congenital cataracts among patients with ophthalmic congenital anomalies

Variables	Congenital Infections		P-value
	No	Yes	
Congenital cataracts			
No	139(100.0)	0(0.0)	0.001*
Yes	101(92.7)	8(7.3)	

*Fisher's Exact Test

The age range of the patients in this study agrees with most previous studies. Only a small number of the children in the study presented within the neonatal period, while the greater proportion presented after the age of 1 year. This is similar to the findings of retrospective studies on ophthalmic congenital anomalies from Southeast Nigeria [23], and Ghana [25]. On the other hand, two other retrospective studies, one from Lagos, Southwest Nigeria [26] and the other from Cameroon [27], reported that majority (70% and 72%) of their patients presented within infancy. The reason for this difference between these studies is not immediately clear but may be related to the shorter duration in the Lagos study, as well as a marked difference between the pattern of congenital anomalies described in the Cameroon study and the present one. Further research using a prospective study design is necessary to establish the pattern of the age at presentation of patients with ophthalmic congenital anomalies in the West African sub-region.

The presentation after infancy in more than half of our patients portrays a tendency towards late presentation especially since the anomalies were present from birth. Such late presentation may be as a result of delayed detection of the anomaly by the parents and/or health care providers, particularly, with the lack of well-organized neonatal screening programmes for ophthalmic congenital anomalies in Nigeria. Alternatively, late presentation may occur despite early detection by parents and early presentation to primary health care centres because inappropriate information and counselling are given to the parents at such centres; for example parents may be told that 'the anomaly would resolve spontaneously' or 'the child is still too young for definitive treatment'.

The issues with late presentation among children with ophthalmic problems have been reported previously [28, 29]. Late presentation has a significantly negative impact on the outcome of treatment and visual development of the child. Indeed, for certain anomalies such as congenital cataract and congenital glaucoma, early diagnosis and treatment are vital to achieving optimal treatment outcome [30]. Therefore, the need for the establishment of screening programmes and surveillance systems for congenital anomalies cannot be overemphasized.

The slight male preponderance observed in our study is in consonance with a number of previous studies [22, 23, 27]. On the contrary, a few other studies have reported a female preponderance for ophthalmic congenital anomalies [26, 31-33]. Notwithstanding, it appears that there is no gender predilection for congenital anomalies, on the whole [26].

Congenital cataracts accounted for almost half of the ophthalmic congenital anomalies in this study, while congenital glaucoma was the second commonest anomaly. This pattern is similar to the findings of five out of six previous Nigerian studies [12, 23, 24, 26, 34]. The study with a different pattern reported that congenital glaucoma was the commonest (38%) closely followed by congenital cataract [22]. All these studies are similar to the present study in that they are hospital-based retrospective studies conducted in university teaching hospitals. However, a striking feature of the latter study, with the differing pattern, is that it is the only study from northern Nigeria. Thus, the difference in frequency distribution might be as a result of geographical variation in the incidence of the different types of ophthalmic congenital anomalies. Further research using a multi-centre study design will be useful in clarifying this variation.

When compared with two similar studies from other countries in West Africa, our finding regarding the frequency of congenital cataract is counterpoised. Actually, the frequency distribution of the anomalies described in this study is similar to the study from Ghana [25] but it is remarkably different from the Cameroon study, which found that the commonest anomaly was congenital nasolacrimal

duct obstruction (CNDO) in 66.7% of their patients [27]. CNDO was much less common in our patients (2.7%) and was the third commonest after cataract and glaucoma in some other Nigerian studies [12, 22, 24]. The difference may be due to dissimilarity in the study settings. The Cameroonian study was conducted in the ophthalmic unit of a Gynaecology, Obstetrics and Paediatrics Hospital, which may be somewhat limited in the range of patients seen while the Nigerian and Ghanaian studies were conducted in university teaching hospitals.

Moreover, the pattern of ophthalmic congenital anomalies in Europe, North America and Asia appears to be different from that of the West African reports including the present study. Most of the studies from the developed countries observed that whole globe anomalies such as microphthalmos and anophthalmos were the more common forms of eye birth defects [31, 35, 36]. On the other hand, these anomalies are reported much less frequently in the West African studies. Less than 10% of the children in this study had microphthalmos or anophthalmos. This difference in the pattern is likely to be a reflection of the higher incidence of rubella infection and consequently rubella cataracts in developing countries compared to developed countries [37]. It may also be due to the difference in study methods. Most of the studies from Europe and North America were large population-based studies in which data was obtained from birth registries and birth defect surveillance programmes, whereas all the West African studies were retrospective and hospital based.

In this study, approximately one-eighth (12.9%) of the patients had associated systemic anomalies. This is comparable to the study by Chuka-Okosa *et al* [23] from southeastern Nigeria that reported 9.3%. Our finding, however, is much lower than the European studies by Stoll *et al* (53.8%) [32] and Bermejo *et al* (78.9%) [35]. This dissimilarity may also be explained by the differences in the study methods as well as by the possibility for better detection of systemic anomalies with active surveillance of birth defects in the European countries. This buttresses the need for the setting up of such screening programmes in the Nigerian health care system.

The systemic anomalies associated with ophthalmic congenital anomalies, in our study, were more commonly found in the cardiovascular system. This is contrary to the report by Chuka- Okosa *et al* [23], who found deafness and cleft lip to be the most prevalent associated systemic anomalies. The explanation for this difference is not clear especially as the pattern of the ocular anomalies observed in the two studies is similar. A possible reason might be the difference in the number of patients studied, 248 in our study compared to 54 in theirs.

Likewise, our finding that cardiovascular anomalies were the commonest systemic association does not echo the findings of the European studies cited earlier [32, 35]. In Bermejo *et al's* report [35], limb anomalies were the commonest systemic association while cardiovascular anomalies ranked eighth in the frequency distribution. In Stoll *et al's* study [32], facial dysmorphia was the commonest association and cardiovascular anomalies were the third commonest. This difference in pattern of systemic association may be explained by the differences in the pattern of ocular anomalies reported in their studies compared to the index study. Congenital cataracts especially those secondary to intrauterine rubella infection are commonly associated with cardiovascular anomalies.

There are a few limitations faced by this study. These include the retrospective nature of the study, the possibility of missing/incomplete records and the lack of information on the incidence and risk factors of ophthalmic congenital anomalies. In addition, the fact that it is a hospital-based study hinders its extrapolation to the general population. Furthermore, the lack of genetic and chromosomal analysis of the identified patients restricted the classification of patients and proper diagnosis of syndromes among them.

Nonetheless, the strengths of this study lie in its multidisciplinary nature of data collection, which ensured a fairly large data pool, and is likely to have had a positive impact on the detection of systemic associations. Secondly, among the Nigerian studies, our study has the largest number of patients. Thus, we believe this report is a fairly accurate representation of the pattern of ophthalmic congenital anomalies seen in Nigerian tertiary hospitals.

In conclusion, this study has demonstrated that the commonest ophthalmic congenital anomaly presenting for tertiary care in Ibadan is congenital cataract. It also shows that cardiovascular anomalies are the commonest systemic association of eye malformations especially congenital cataract. We advocate for the establishment of a registry for congenital anomalies with effective screening and active surveillance in our health system. This would generate much needed data on the epidemiology of congenital anomalies including ophthalmic anomalies in our population.

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Biochemical nutritional parameters and anthropometric measurements in Nigerian pulmonary tuberculosis patients before and during chemotherapy

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Abstract

Background: Epidemiological studies have demonstrated an overlap between malnutrition and tuberculosis (TB) in most developing countries, but reports of changes in nutritional status throughout TB treatment are scarce. The objective of this study was to determine the nutritional status of pulmonary TB patients before and during anti TB chemotherapy.
Materials and methods: This study comprised of sixty eight (68) participants, twenty-four (24) multi-drug-resistant TB (MDR-TB) patients, twenty-four (24) drug-sensitive TB patients(DS-TB) and 20 non-TB apparently healthy individuals. TB patients were followed-up throughout 6 months of anti-TB chemotherapy. Anthropometric measurements; mid-upper arm circumference(MUAC), weight, body mass index(BMI), percentage body fat(PBF), fat mass index(FMI), fat-free mass index(FFMI), waist circumference(WC), hip circumference(HC), waist-hip ratio(WHR), and plasma proteins(total protein, transferrin, retinol binding protein–RBP, pre-albumin and albumin) concentrations were determined.
Results: Under nutrition (BMI <18.5 kg/m^2) was observed in 65% and 23.1% of MDR-TB patients and DS-TB patients respectively. MUAC, weight, BMI, FFMI, WC and HC were significantly reduced before commencement- and at 2 months of chemotherapy in DS-TB patients compared with controls. Plasma transferrin and pre-albumin levels were significantly increased at 2 and 4 months of chemotherapy respectively, but plasma albumin levels were increased at 2 and 4 months of chemotherapy in DS-TB patients compared with controls. In MDR-TB patients, MUAC, weight, BMI, PBF, FMI and FFMI decreased significantly before and 2 months of chemotherapy compared with controls. Plasma albumin and HC decreased significantly before chemotherapy, while plasma TP and RBP increased before chemotherapy and 2 months of chemotherapy in MDR-TB patients compared with controls. At 4 months of anti-TB chemotherapy, MUAC was decreased while plasma total protein, pre-albumin and albumin increased significantly in MDR-TB patients compared with controls. Plasma transferrin and albumin increased significantly at 6 months of chemotherapy in MDR-TB patients compared with controls.
Conclusion: Protein-calorie under nutrition remains a major challenge in TB patients and nutritional support for TB patients during anti-TB chemotherapy could ensure quicker recovery.

Keywords: *Under nutrition; tuberculosis; chemotherapy, anthropometry; proteins*

Résumé

Contexte: Les études épidémiologiques ont démontré un chevauchement entre la malnutrition et la tuberculose (TB) dans la plupart des pays en voie de développement, mais les rapports d'évolution de l'état nutritionnel pendant le traitement de la tuberculose sont rares. L'objectif de cette étude était de déterminer l'état nutritionnel des patients tuberculeux pulmonaires avant et pendant la chimiothérapie anti-tuberculose.
Matériaux et méthodes: Cette étude comprenait soixante-huit (68) patients atteints de tuberculose, vingt-quatre (24) patients atteints de tuberculose multi-médicament-résistante (TB- MMR), vingt-quatre (24) patients atteints de tubercules sensibles aux médicaments (TB-SM) et 20 non tuberculeux apparemment en bonne santé. Les patients atteints de tuberculose ont été suivis pendant 6 mois de chimiothérapie antituberculeuse. Les mesures anthropométriques; la circonférence du milieu de l'avant-bras (CMAB), le poids, l'indice de masse corporelle (IMC), le pourcentage de graisse corporelle (PGC), l'indice de masse graisseuse (IMG), l'indice de masse sèche (IMS), le périmètre de la taille (PT), la circonférence de la hanche (CH), le rapport taille-hanche (RTH) et les concentrations de protéines plasmatiques (protéines totales, transferrine, protéines de liaison rétinol - PLR, pré-albumine et albumine) ont été déterminés.
Résultats: La sous-nutrition (IMC <18,5 kg/m^2) a été observé chez 65% et 23,1% des patients TB-MMR et des patients TB-SM respectivement. La CMAB, le poids, l'IMC, l'IMS, le PT et la CH ont

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été considérablement réduits avant le début et à 2 mois de chimiothérapie chez les patients atteints de TB-SM par rapport aux témoins. Les concentrations plasmatiques de transferrine et de pré-albumine ont été significativement augmentées à 2 et 4 mois de chimiothérapie respectivement, mais les concentrations plasmatiques d'albumine ont été augmentées à 2 et 4 mois de chimiothérapie chez les patients atteints de TB-SM par rapport aux témoins. Chez les patients atteints de TB- MMR, la CMAB, le poids, l'IMC, le PGC, l'IMG et l'IMS ont diminué de manière significative avant et 2 mois de chimiothérapie par rapport aux témoins. L'albumine plasmatique et la CH ont diminué de manière significative avant la chimiothérapie, tandis que le plasma TP et PLR ont augmenté avant la chimiothérapie et 2 mois de chimiothérapie chez les patients atteints de TB- MMR par rapport aux témoins. À 4 mois de chimiothérapie antituberculeuse, la CMAB a diminué tandis que la protéine totale du plasma, la pré-albumine et l'albumine ont augmenté de manière significative chez les patients TB- MMR par rapport aux témoins. La transferrine plasmatique et l'albumine ont augmenté de manière significative à 6 mois de chimiothérapie chez les patients TB- MMR par rapport aux témoins.

Conclusion: La protéine calorique sous-nutrition reste un défi majeur chez les patients atteints de tuberculose et le soutien nutritionnel pour les patients atteints de tuberculose pendant la chimiothérapie anti-TB pourrait assurer une récupération plus rapide.

Mots-clés: S*ous nutrition; Tuberculose; Chimiothérapie, anthropométrie; Protéines*

Introduction

Malnutrition and tuberculosis are both problems of considerable magnitude in most developing countries, and epidemiological studies have demonstrated an overlap between these conditions in low income countries [1]. Among other risk factors, malnutrition has been reported to predispose to the development of active tuberculosis (TB). Also, active tuberculosis leads to aggravation of malnutrition due to reduced appetite, nutrient malabsorption, altered metabolism and increased excretion [2]. This accounts for the age-long link between consumption/wasting and active tuberculosis [3]. However, the nature of the interaction between these two conditions has been widely speculative and largely inconclusive [4]. Before the advent of anti tuberculosis chemotherapy, a diet rich in calories, proteins, fats, minerals and vitamins was generally considered an essential factor in treatment of tuberculosis. The introduction of anti-tuberculosis drugs, however has altered the management of tuberculosis and the role of diet is given little to no consideration in tuberculosis management. Malnutrition in tuberculosis patients may directly or indirectly affect treatment outcomes as it has been reported that malnourished TB patients have delayed recovery and higher mortality rates than well nourished patients [2, 5].

TB remains a major public health priority as worldwide 9.6 million people were estimated to have TB and 1.5 million died from *Mycobacterium tuberculosis* infection in 2014 [5]. Efforts towards eradication of TB have been hampered by emergence of drug resistant strains of *Mycobacterium tuberculosis*. A study reported a 90% cure rates of pulmonary tuberculosis cases using directly observed treatment short course (DOTS) strategy [6]. Treatment outcomes of TB are not entirely dependent on use of appropriate anti-TB drugs only, but also inefficient cellular immunity which may be a result of poor nutritional status [7].

Food insecurity and hunger are common in Africa due to a combination of climatic, economic, policy and political factors [8]. Analysis of multiple demographic and nutrition surveys estimated that 10-20% of African adults 20-49 years of age are malnourished, with protein-calorie malnutrition being reported as the common form of malnutrition [9-11]. It has been suggested that protein-calorie malnutrition, by reducing the expression of gamma interferon, tumour necrosis factor alpha, and other mycobactericidal substances may selectively compromise portions of the cell-mediated immune response that are important for containing and restricting *Mtb* [12,13]. Correlation of protein-calorie malnutrition and growth retardation allows assessment of individual nutritional status by measurement of growth indicators such as mid-upper arm circumference, weight and body mass index (BMI). Low BMI (<18.5 kg/m^2) and lack of adequate weight gain following TB treatment have been associated with increased risk of death [14,15] and TB relapse [16,17]. Also, waist circumference (WC), hip circumference (HC) and percentage body fat (PBF) are measures of bodily fat mass. These measures have been extensively employed in assessment of nutritional status in health and disease. Transferrin, retinol binding protein (RBP), pre-albumin and albumin are markers of protein nutritional status [4].

Previous studies concentrated on anthropometric measurements as markers of macronutrient status in TB patients. In addition, studies [1, 4, 12] on changes in biochemical nutritional factors and anthropometric indices throughout treatment of either DS-TB patients, MDR-TB patients or both are scarce. This study assessed macronutrient status of drug sensitive and drug resistant pulmonary tuberculosis patients by combination of anthropometric measurements and plasma protein concentrations before and during anti-TB treatment.

Materials and methods

Study setting: University College Hospital, Ibadan, Nigeria
Study design: Case control
Study Instruments: Structured questionnaires and laboratory tests
Study variables: Anthropometric measurements (mid-upper arm circumference, weight, body mass index, percentage body fat, fat mass index, fat-free mass index, waist circumference, hip circumference, waist-hip ratio) and plasma proteins(total protein, transferrin, retinol binding protein–RBP, pre-albumin and albumin).

Study participants

Sixty eight (68) participants were enrolled for this study, this comprised of twenty four (24) multi-drug-resistant TB (MDR-TB) patients, twenty four (24) drug-sensitive TB patients (DS-TB) and twenty (20) non-TB apparently healthy individuals. MDR-TB patients had been previously diagnosed as being infected with isoniazid and rifampicin resistant strains of Mtb using clinical history, Chest X-ray and GENE Xpert. These patients were admitted into the MDR TB centre, University College Hospital (UCH) Ibadan, Nigeria for anti-TB treatment. DS-TB patients were recruited from the Medicine Out-patient Clinic, University College Hospital, Ibadan, Nigeria by a Consultant Chest Physician after confirmation with laboratory tests, chest X-ray and clinical history. The study protocol was reviewed and approved by the University of Ibadan/University College Hospital Joint Institutional Research Ethics Committee. Informed consent was obtained before data and samples collection from study participants.

Five (5) milliliters of blood was drawn from the anti cubital fossa vein into sterile lithium heparin tubes before commencement of chemotherapy, 2 months, 4 months and 6 months of anti-TB therapy. Blood samples were centrifuged and plasma obtained were analyzed.

Anthropometric measurements

Mid upper arm circumference (MUAC)

MUAC was measured using a measuring tape. Tape was extended around the mid upper arm of participant while the arm was straight and relaxed. Measurement was taken to the nearest 0.1cm and recorded.

Weight and Percentage body fat (PBF)

Weight and PBF were measured with a bioelectrical impedance analysis (BIA) scale (Intelli Scale BS0114, China) which was placed on a flat surface. Study participants wore light clothing and were without shoes before they stood on the scale.

Waist circumference (WC)

This was measured using a measuring tape. Participants were instructed to raise their cloth above waist and cross their arms at chest level while maintaining an upright posture. Measurements were taken by extending the measuring tape around the participants from the belly button.

Hip circumference (HC)

This was measured using a measuring tape extended around the hip of study participants while maintaining an upright posture.

Indices and Ratios

The following indices and ratios were calculated using their respective formulae;

$$\text{Body mass index (BMI)} = \frac{\text{Weight (kg)}}{\text{Height}^2\ (\text{m}^2)}$$

$$\text{Fat Mass Index (FMI)} = \frac{\text{Fat mass (kg)}}{\text{Height}^2\ (\text{m}^2)}$$

$$\text{Fat mass} = \text{PBF x Body weight}$$

$$\text{Fat Free Mass Index (FFMI)} = \frac{\text{Fat free mass (kg)}}{\text{Height}^2\ (\text{m}^2)}$$

$$\text{Fat free mass} = \text{Body weight} - \text{Fat mass}$$

Waist circumference to Hip circumference ratio

$$\text{(WHR)} = \frac{\text{Waist circumference (cm)}}{\text{Hip circumference (cm)}}$$

PTB Treatment protocol

All bacteriologically confirmed MDR-TB patients received intensive phase for 6-8 months in the hospital followed by 12 months of continuation phase in the community based on WHO updated guidelines in 2011 [18]. Standardized treatment regimen was done using five drugs namely: Kanamycin/Amikacin, Levofloxacin, Prothionamide, Cycloserine, Pyrazinamide and Pyridoxine). This present study was conducted during the intensive phase of treatment.

Patients admitted for MDR-TB treatment, received support from non-governmental organizations which provided nutritional assistance in the form of meals and micronutrient supplements. Vitamin C (Spartan C), Folic acid (Vitabiotics), Vitamin B complex (Vitabiotics), Vitamin B6 (Pauco) and multivit (Pauco) supplements were administered daily with anti-TB drugs as part of the treatment regimen at the study site .

Sputum smear positive DSTB patients received DOTS intensive phase for 2 months and 4

months continuation in the hospital, as recommended in the 2011 WHO updated guidelines [18]. Standardized treatment regimen with fixed drugs containing; Rifampicin, Isoniazid, Pyrazinamide and Ethambuthol during intensive phase, and Rifampicin and Isoniazid in continuation phase, were used. Drug sensitive TB patients were treated at Out-Patient Clinic and did not benefit nutritional support during the period of anti-TB treatment.

Biochemical analysis

Enzyme-linked immuno sorbent assay (ELISA) was used to measure transferrin (Transferrin; AssayproInc, USA), retinol binding protein (RBP; Lot #-15C1, Part #-E-80RBP, Immunology Consultants Laboratory Inc, Portland), albumin (Albumin; Lot #-17, Part #-E-80AL, Immunology Consultants Laboratory Inc, Portland) and prealbumin (Prealbumin, Lot #-11Q1, Part #-E-80PRE, Immunology Consultants Laboratory Inc, Portland). Assay protocol was as specified by the manufacturer and the absorbance of all the assays was measured at 450nm with an ELISA reader (Spectra Max Plus 384, Molecular Devices LLC, USA). The procedure was carried out as previously described [19].

Statistical analysis

Data obtained was analyzed using statistical package for social sciences (SPSS) version 17.0. Independent Student t-test was used to compare the mean values of PTB patients and controls, while paired t-test was used to compare the mean values of PTB patients before commencement of chemotherapy, 2 months, 4 months and 6 months of anti-TB chemotherapy. Values were considered significant at $p<0.05$.

Results

Under-nutrition was observed in 65% and 23.1% of MDR-TB and DS-TB patients respectively before commencement of chemotherapy while, controls were all normal weight individuals. In MDR-TB patients, the percentage of underweight patients increased to 70% after 2 months of anti-TB chemotherapy and declined to 15% and 5.6% at 4 months and 6 months of anti-TB chemotherapy respectively. In DS-TB patients on the other hand, the percentage of underweight patients decreased to 20% at 2 months of anti-TB chemotherapy and 0% at 4 months and 6 months of anti-TB chemotherapy. (Table 1)

Drug-sensitive TB

The anthropometric measurements MUAC, weight, BMI, FFMI, WC and HC were significantly reduced in DS-TB patients before anti-TB chemotherapy, at 2 months of anti-TB chemotherapy when compared with control. Plasma concentrations of transferrin and albumin of DS-TB patients were significantly increased at 2 months of anti-TB chemotherapy when compared with controls. Significant increases in plasma concentrations of pre-albumin and albumin of DS-TB patients at 4 months of anti-TB chemotherapy when compared with controls were also observed. There were also significant increases in weight and plasma concentration of pre-albumin of DS-TB patients at 4 months of chemotherapy when compared with their levels before anti-TB chemotherapy. Plasma concentration of transferrin of DS-TB patients was reduced significantly, while weight was increased at 6 months of anti-TB chemotherapy when compared with the values before commencement of chemotherapy. (Table 2).

Table 1: Proportion of participants with undernutrition (BMI <18.5 kg/m^2)

Group	No of participants	BMI <18.5 kg/m^2 (%)	BMI <18.5 kg/m^2 (%) – MDR-TB	BMI <18.5 kg/m^2 (%) – DS-TB
Control	20	0		
Before chemotherapy	48		65.5	23.1
2 months of chemotherapy	48		70.0	20.0
4 months of chemotherapy	48		15.0	0.0
6 months of chemotherapy	48		5.6	0.0

Multi-drug resistant TB

Anthropometric measurements MUAC, weight, BMI, PBF, FMI and FFMI were significantly reduced in MDR-TB patients before and at 2 months of anti-TB chemotherapy when compared with controls.

Table 2: Anthropometric measurements and plasma concentrations of markers of nutritional status in DS-TB patients before and during chemotherapy and in healthy controls

Parameters	Control (n=20)	Before chemotherapy (n=24)	2months (n=24)	4months (n=24)	6months (n=24)
MUAC *(cm)*	27.4±2.3	24.6±3.3*	25.2±2.6*	27.0±3.9	26.8±3.0
Weight *(kg)*	67.0±14.1	56.5±10.4*	59.6±8.3*	65.9±10.9^{o}	65.9±8.0^{o}
BMI *(kg/m^2)*	22.9±3.4	20.4±3.8*	20.4±2.2*	23.1±4.8	22.9±2.5
PBF *(%)*	24.2±8.5	22.0±10.3	21.0±8.9	25.5±10.8	20.4±9.0
FMI *(kg/m^2)*	5.7±2.6	5.2±4.4	4.6±2.4	4.7±1.9	4.4±2.4
FFMI *(kg/m^2)*	17.2±2.1	15.8±1.9*	15.9±1.8*	16.1±1.9	16.5±1.7
WC *(cm)*	75.0±23.7	72.0±9.5*	71.9±5.5*	78.6±9.8	75.3±6.3
HC *(cm)*	92.8±15.2	89.2±8.3*	91.2±5.3*	94.3±6.5	94.5±6.8
WHR	0.8±0.2	0.86±0.06	0.84±0.03	0.88±0.06	0.85±0.03
Total Protein *(g/L)*	59.8±8.9	58.9±6.3	60.6±3.9	56.5±6.5	58.7±2.3
Transferrin *(g/L)*	167.6±39.5	187.0±40.7	188.6±29.8*	167.0±9.0	151.3±17.0^{o}
RBP *(mg/L)*	55.1±7.0	53.6±14.0	50.6±6.8	57.0±7.6	50.7±8.9
Pre-albumin *(mg/L)*	272.3±87.1	261.0±78.8	313.9±78.2	339.2±33.0*^{o}	339.5±113.5
Albumin *(g/L)*	37.0±22.0	45.5±10.9	53.2±6.2*	55.5±17.3*	52.7±27.4

**Significantly different from Control ($p<0.05$)*

^{o}*Significantly different from before commencement of chemotherapy ($p<0.05$)*

Table 3: Anthropometric measurements and plasma concentrations of markers of nutritional status in MDR-TB patients before and during chemotherapy and in healthy controls

Parameters	Control (n=20)	Before chemotherapy (n=24)	2months (n=24)	4months (n=24)	6months (n=24)
MUAC *(cm)*	27.4±2.3	23.0±2.7*	24.0±2.0*	24.6±2.5*	25.3±2.6^{o}
Weight *(kg)*	67.0±14.1	50.9±8.3*	47.1±10.4*	60.4±8.5^{o}	64.2±7.9^{o}
BMI *(kg/m^2)*	22.9±3.4	17.8±3.1*	16.5±4.0*	21.1±3.1^{o}	22.5±3.2^{o}
PBF *(%)*	24.2±8.5	13.4±7.5*	13.6±11.2*	20.5±9.4^{o}	22.5±10.1^{o}
FMI *(kg/m^2)*	5.7±2.6	2.6±1.9*	2.6±2.9*	4.5±2.7^{o}	5.3±3.0^{o}
FFMI *(kg/m^2)*	17.2±2.1	15.3±1.9*	13.9±1.8*^{o}	16.6±1.8^{o}	17.2±1.8^{o}
WC *(cm)*	75.0±23.7	73.6±6.1	78.3±8.4	78.2±7.7	81.5±7.7^{o}
HC *(cm)*	92.8±15.2	84.7±5.7*	90.2±7.3^{o}	91.6±6.7^{o}	93.9±7.2^{o}
WHR	0.8±0.2	0.9±0.04	0.9±0.05	0.9±0.05	0.9±0.05
Total Protein *(g/L)*	59.8±8.9	75.9±3.3*	76.6±6.6*	70.1±8.2*^{o}	65.5±9.4^{o}
Transferrin *(g/L)*	167.6±39.5	198.8±42.6	122.7±63.7^{o}	233.6±132.8	354.0±53.0*^{o}
RBP *(mg/L)*	55.1±7.0	66.4±9.9*	70.1±17.4*	55.3±10.7^{o}	63.0±18.8
Pre-albumin *(mg/L)*	272.3±87.1	247.2±54.7	264.0±28.5	332.1±63.9*^{o}	303.9±43.6^{o}
Albumin *(g/L)*	37.0±22.0	16.3±3.6*	45.9±17.3^{o}	69.9±13.6*^{o}	64.1±9.2*^{o}

**Significantly different from Control ($p<0.05$)*

^{o}*Significantly different from before commencement of chemotherapy ($p<0.05$)*

Mean HC and plasma albumin concentration of MDR-TB patients decreased significantly after 2 months of anti-TB chemotherapy, while plasma RBP of MDR-TB patients increased significantly at 2 months and 4 months of anti-TB chemotherapy when compared with controls. Though MUAC of MDR-TB patients decreased significantly at 4 months of anti-TB chemotherapy, plasma pre-albumin and albumin concentrations in MDR-TB patients increased significantly at 4 months and 6 months of anti-TB chemotherapy respectively when compared with controls. Plasma TP was significantly raised before, at 2 months and 4 months of chemotherapy in MDR-TB patients compared to controls. (Table 3)

While there were significant increases in weight, BMI, PBF, FMI, FFMI and plasma pre-albumin concentration of MDR-TB patients at 4 months and 6 months of anti-TB chemotherapy, there were significant decreases in PBW and TP of MDR-TB patients at 4 months and 6 months of anti-TB chemotherapy when compared with mean values before commencement of chemotherapy. Mean HC and plasma albumin concentrations of MDR-TB patients increased significantly at 2 months, 4 months and 6 months of anti-TB chemotherapy when compared with mean values before anti-TB chemotherapy. Although plasma RBP concentration of MDR-TB patients decreased significantly at 4 months of anti-TB chemotherapy, MUAC, WC and plasma transferring concentrations of MDR-TB patients increased significantly at 6 months of anti-TB chemotherapy when compared with mean values before anti-TB chemotherapy. (Table 3)

There were significant decreases in BMI, PBF, FMI and albumin whereas TP and RBP were significantly increased in MDR-TB patients when compared to DS-TB patients before chemotherapy. (Table 4).

Table 4: Anthropometric measurements and plasma concentrations of markers of nutritional status in DSTB and MDR-TB patients before chemotherapy.

Parameters	DS-TB before Chemotherapy (n=24)	MDR-TB before Chemotherapy (n=24)	t	P value
MUAC *(cm)*	24.6±3.3	23.0±2.7	-1.994	0.055
Weight *(kg)*	56.5±10.4	50.9±8.3	-2.027	0.051
BMI *(kg/m²)*	20.4±3.8	17.8±3.1	-2.052	0.049*
PBF *(%)*	22.0±10.3	13.4±7.5	-2.545	0.017*
FMI *(kg/m²)*	5.2±4.4	2.6±1.9	-2.352	0.026*
FFMI *(kg/m²)*	15.8±1.9	15.3±1.9	-0.672	0.507
WC *(cm)*	72.0±9.5	73.6±6.1	-1.065	0.295
HC *(cm)*	89.2±8.3	84.7±5.7	-1.912	0.065
WHR	0.86±0.06	0.9±0.04	1.183	0.246
Total Protein *(g/L)*	58.9±6.3	75.9±3.3	9.504	0.000*
Transferrin *(g/L)*	187.0±40.7	198.8±42.6	0.845	0.405
RBP *(mg/L)*	53.6±14.0	66.4±9.9	3.311	0.002*
Pre-albumin *(mg/L)*	261.0±78.8	247.2±54.7	-0.858	0.397
Albumin *(g/L)*	45.5±10.9	16.3±3.6	-9.733	0.000*

**Significant at* $p<0.05$

Discussion

This present study reports under-nutrition in 48.5% of the TB patients before commencement of anti-TB chemotherapy. This finding is in consonance with the reports of Mupere *et al* [20], Dodor [21], and Zachariah *et al* [15] who reported under-nutrition in 42%, 51% and 57% of TB patients in Uganda, Ghana and Malawi respectively. It is however lower than 71.6% reported by Kennedy *et al* [22] in Tanzanian TB patients. Under-nutrition has been associated with alterations in immune function which increases susceptibility to infection and may also aggravate development and progression of active TB infection [12]. It is also suggested that under-nutrition alters effectiveness of medication, vaccine efficacy and increases mortality of TB patients [23-26]. Due to the viscous cycle of TB and under-nutrition, it is difficult to establish if under—nutrition results in active TB or active TB results in under-nutrition, but the high prevalence of under nutrition in TB patients reported in this present study indicates that under-nutrition is still a major concern in TB patients. Hence, there is a need for assessment of nutritional status of TB patients at diagnosis.

Anthropometric indicators are regularly measured and interpreted to assess malnutrition [16]. This study found reduced anthropometric measures of nutritional status in DS-TB and MDR-TB patients before commencement of anti-TB chemotherapy when compared to healthy controls. Lower mean mid-upper arm circumference, weight, BMI and hip circumference in DS-TB and MDR-TB patients, WC and PBF in DS-TB and MDR-TB patients respectively compared with controls represent loss of both fat and fat-freemass in these patients as

shown by decreases in FMI and FFMI. This could be a result of a shift in metabolism in favour of increased catabolism and increased protein loss (negative nitrogen balance), or decreased nutrient supply due to anorexia and/or malabsorption. Studies of protein and energy metabolism in infection previously demonstrated metabolic changes in acute, sub-acute and chronic infectious diseases [27]. Increased energy demand and expenditure determined by increased oxidation of fat and breakdown of lean tissue for energy were reported in several infectious diseases including TB [28]. Macallan *et al* [28] further hypothesized that there is a block to the anabolic response to nutrition in TB patients thereby hampering utilization of exogenous nutrient supply in these patients. These may explain the loss of fat and fat-free mass in TB patients observed in this study. Moreso, it also supports the age-long association between tuberculosis and wasting as well as previous reports of protein-calorie malnutrition in TB patients [1,21,29-31].

Conventional TB treatment involves the use of combinations of anti-TB therapeutic drugs for at least 6 months. The length of treatment and side-effects of the drugs have been identified among factors responsible for patients' non-compliance with treatment, which has largely resulted in the emergence of drug resistant strains of Mtb. In DS-TB, only weight increased significantly at 4 months and 6 months of anti-TB chemotherapy when compared with before chemotherapy. In MDR-TB on the other hand, MUAC, weight, BMI, PBF, FMI, FFMI, WC and HC were increased at 4 months and 6 months of chemotherapy when compared with before chemotherapy. The differences observed between DS-TB and MDR-TB patients may be as a result of nutritional support received by MDR-TB patients.

This study therefore proposes that a balanced diet and micronutrient supplementation can be added to conventional anti-TB drugs. This is particularly necessary in developing regions of the world where poverty and food insecurity are endemic. Improved nutritional status of TB patients could also lead to immunologic changes that may enhance Mtb clearance and reduce infectiousness of patients. However, there is a need for further studies to determine the optimal amount and combinations of nutrients for better nutritional, immunological and treatment outcomes in these patients. The present finding is in consonance with the study of Paton *et al* [27] where increased body weight and lean mass of TB patients on energy-protein supplement compared to a non-supplemented group was reported.

Components of plasma protein are altered in different physiological and pathological conditions. This study found decreased plasma albumin with increased total protein and RBP concentrations in MDR-TB patients before commencement of anti-TB chemotherapy when compared with controls. Decreased plasma albumin with increased plasma total protein concentration in MDR-TB patients before chemotherapy might be an indication of electrophoretic pattern of plasma proteins seen in chronic inflammation which is characterized by reduction in the albumin band and a marked increase in gamma globulin band. Inflammation is a phenomenon in TB patients as shown by the results of this study. Elevated gamma-globulins with concomitant reduced albumin in TB patients have been previously reported [32,33]. The increase in gamma-globulins represents increased production of immunoglobulin classes in TB patients, though the roles of immunoglobulins in defence against Mtb are largely unclear. Reduced albumin in MDR-TB patients before chemotherapy on the other hand may be suggestive of either malnutrition or an acute phase response. However, in acute phase response, a decrease in plasma RBP is expected but we found increased plasma RBP with reduced plasma albumin. This is plausible since most of the MDR-TB patients in this study were not severely ill before commencement of chemotherapy. Reduced plasma albumin may be due to reduced albumin synthesis or increased albumin utilization. Paton *et al* [27] previously suggested an anabolic block in TB. Our study goes further to propose that this anabolic block may affect synthesis of selected proteins but not all proteins in TB patients. In addition, reduced plasma albumin before chemotherapy might be due to utilization of albumin in scavenging free radical as previously demonstrated in TB patients [34-36].

Proper TB treatment helps restore nutritional status. However, the time of nutritional recovery may be long and many TB patients remain undernourished after TB treatment is completed [37]. This present study found significant increases in the concentrations of plasma proteins albumin, pre-albumin and transferrin in MDR-TB patients at 4 months and 6 months of anti-TB chemotherapy, whereas pre-albumin alone was significantly increased at 4 months of anti-TB chemotherapy in DS-TB patients. This further supports the need for provision of nutritional support for TB patients on anti-TB chemotherapy to ensure early recovery.

In conclusion, protein-calorie under nutrition remains a major challenge in TB patients and nutritional support in the form of controlled diet and micronutrient supplements should be given to TB patients during anti-TB chemotherapy to ensure quick recovery.

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Exogenous administration of adenosine enhanced glucose uptake in canine hind limb at rest and during contraction

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Abstract
Background: Glucose metabolism increases during contraction of skeletal muscle and can be influenced by the endogenous adenosine. However, the role of exogenous adenosine in regulating glucose uptake at rest or during contraction has not been elucidated in dogs. We studied the effects of exogenous adenosine on glucose uptake in canine hind limb at rest and during contraction.
Methods: The study was carried out using thirty (30) fasted and anaesthetized male dogs divided into six groups (5dogs/group). Groups I (control) and II received normal saline (0.1ml/kg) at rest and during contraction of hind limb respectively. Group III received adenosine (0.1, 0.5 and 1mg/kg) at rest. Group IV were treated with adenosine (1mg/kg) during contraction. Groups V and IV were pretreated with caffeine (6mg/kg) and infused with adenosine (1mg/kg) for thirty minutes at rest and during contraction of the hind limb respectively. Blood glucose was measured by glucose oxidase method. Arterio-venous (A-V) glucose and venous blood flow (VBF) were measured; hind limb glucose uptake (HGU) was calculated as the product of A-V glucose and VBF.
Results: The results showed that exogenously administered adenosine significantly (P<0.05) increased A-V glucose, VBF and HGU in a dose dependent manner at rest. During contraction adenosine increased A-V glucose significantly from14.2±0.5mg/dl to 45.4±1.8ml/min. VBF also significantly increased from 4.7±0.6ml/min to 16.3±1.2 and HGU from 34.8±2.4 to 450.8±8.2mg/ /min. Pretreatment with caffeine significantly reduced adenosine-induced hyperglycemia at rest and during contraction.
Conclusion: Exogenous adenosine at rest and during contraction increases the skeletal muscle glucose uptake and the increase appears to be mediated by inhibition of adenosine receptors.

Keywords: *Adenosine, Caffeine. Dog, glucose uptake, hind limb*

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Résumé - 3710
Contexte: Le métabolisme du glucose augmente pendant la contraction du muscle squelettique et peut être influencé par l'adénosine endogène. Cependant, le rôle de l'adénosine exogène dans la régulation de l'absorption de glucose au repos ou pendant la contraction n'a pas été élucidée chez les chiens. Nous avons étudié les effets de l'adénosine exogène sur l'absorption de glucose dans le membre postérieur canin au repos et pendant la contraction.
Méthodes: L'étude a été menée à l'aide de trente (30) chiens mâles en jeûnés et anesthésiés répartis en six groupes (5 chiens / groupe). Les groupes I (témoin) et II ont reçu une solution saline normale (0,1 ml / kg) au repos et pendant la contraction du membre postérieur respectivement. Le groupe III a reçu de l'adénosine (0,1 ; 0,5 et 1 mg / kg) au repos. Le groupe IV a été traité avec de l'adénosine (1 mg / kg) pendant la contraction. Les groupes V et IV ont été prétraités avec de la caféine (6 mg / kg) et infusés avec de l'adénosine (1 mg / kg) pendant 30 minutes au repos et pendant la contraction du membre postérieur respectivement. La glycémie a été mesurée par la méthode de l'oxydase du glucose. Le glucose sanguin artério-veineux (A-V) et le flux sanguin veineux (VBF) ont été mesurés; l'absorption de glucose des membres postérieurs (HGU) a été calculée comme le produit du glucose A-V et du VBF.
Résultats: Les résultats ont montré que l'adénosine administrée exogène de manière significative (P <0,05) a augmenté le glucose A-V, VBF et HGU de manière dépendante de la dose au repos. Pendant la contraction, l'adénosine a augmenté le glucose A-V significativement de 14,2 ± 0,5 mg / dl à 45,4 ± 1,8 ml / min. VBF a également augmentée de 4,7 ± 0,6 ml / min à 16,3 ± 1,2 et HGU de 34,8 ± 2,4 à 450,8 ± 8,2 mg / min. Le prétraitement avec la caféine a considérablement réduit l'hyperglycémie induite par l'adénosine au repos et pendant la contraction.
Conclusion: L'adénosine exogène au repos et pendant la contraction augmente l'absorption du glucose dans le muscle squelettique et l'augmentation semble être par la médiation de l'inhibition des récepteurs de l'adénosine.

Mots-clés: *Adénosine, Caféine. Chien, absorption de glucose, membre postérieur*

Introduction

Skeletal muscle comprises about 40% of total body mass in mammals and accounts for 30% of the resting metabolic rate in adult humans [1]. Skeletal muscle has a critical role in glycaemic control, metabolic homeostasis, and is the predominant site of glucose disposal under insulin stimulated conditions [2]. It is the largest glycogen storage organ having 4-fold the capacity of the liver. During exercise, the increase in glucose uptake from the circulation provides fuel to meet energy demand of contracting muscles [3,4]. Therefore, the regulation of glucose transport, metabolism or storage of glycogen by insulin and exercise is of critical importance in maintaining glucose homeostasis with significant implications for patients with insulin resistance [5]. Decrease in response to insulin but not to exercise leading to decreased glucose transport in skeletal muscle is a major factor responsible for insulin resistance associated with diabetes mellitus [6].

Reports indicate that one of the locally produced compounds in muscles, adenosine, has potent glucose metabolism and uptake activity [7]. Adenosine is a naturally occurring compound that is elaborated in the myocardium in response to hypoxia and under conditions in which there is increased demand for oxygen. Adenosine is principally formed on degradation of intracellular ATP when high-energy phosphate use exceeds its formation [8,9]. ATP is hydrolyzed to ADP and then to AMP when high energy phosphate reserves are compromised through the action of 58-nucleotidase. AMP is hydrolyzed to adenosine, which then diffuses into the interstitial space [8]. Report indicate that biological functions of extracellular adenosine are mediated by four different G-protein coupled receptors that are classified as adenylyl cyclase inhibiting (A_1 and A_3) or adenylyl cyclase activating (A_{2a} and A_{2b}) receptors [10,11]. Previous pharmacological studies on the effect of adenosine on glucose uptake have shown that it increases or stimulates glucose uptake in adipose tissues in human [12,13], dogs [14] and rats [15]. Studies have also established adenosine's ability to activate myocardial glucose uptake [16,17].

Reports on the role of adenosine on glucose uptake by the skeletal muscle are inconsistent. For example; a study indicates that adenosine deaminase (ADA), which converts adenosine to inactive metabolite inosine, and 1,3-dipropyl-8-cyclopentylxanthine (DPCPX) can decrease both insulin and contraction stimulated glucose uptake [18]. It was also shown that N^6-cyclopentyladenosine (CPA) a selective adenosine A_1 receptor agonist increases the glucose uptake in steptozotocin-induced diabetic rats, an effect that was blocked by adenosine antagonists [19]. Furthermore during a euglycemic-hyperinsulinemic clamp, it was also observed that caffeine an adenosine antagonist impaired the glucose uptake at rest and in exercising human skeletal muscle [20].

Contrary to this, several reports have consistently shown that while adenosine impairs on one hand, on the other hand adenosine deaminase and adenosine antagonists improve insulin sensitivity in skeletal muscle [21-23]. Furthermore, one study showed that adenosine, via A_1 affects insulin-mediated glucose uptake in rat skeletal muscles only in the presence of a submaximal concentration of insulin [24]. This supports the finding of a stimulatory action of adenosine on insulin-stimulated glucose uptake in striated muscle during contraction. Skeletal muscle contains several interstitial metabolites including adenosine. There are reports that suggest that interstitial concentration of adenosine was very low and the rate of its release in well- oxygenated muscle is very slow at the resting state. This rate may be insufficient to cause significant adenosine receptors activation in the resting skeletal muscle preparation when it is compared to during contraction.

The question to ask now is: What is the effect of exogenous infusion of adenosine on glucose uptake at rest and during electrical stimulation?

The present study was therefore designed to study the effect of infusion of adenosine on the glucose uptake by the canine hind limb at rest and during contraction. In addition, we also investigate the effect of caffeine a non-selected antagonist on effect of adenosine.

Materials and methods

Experimental design and treatment

Male mongrel dogs weighing 11-13 kg were used for the study. The animals were divided into six groups with 5 dogs per group.

Group I served as control and received normal saline (0.1 ml/kg) at rest, group II received normal saline with hind limb muscle contraction, Group III were infused with adenosine at doses of 0.1, 0.5 or 1 mg/kg for thirty minutes at rest, group IV was infused with adenosine (1 mg/kg) with hind limb muscle contraction, group V animals were pretreated with caffeine (6 mg/kg) before infusion of adenosine (1 mg/kg) at rest and lastly group VI were pretreated with caffeine (6 mg/kg) adenosine (1 mg/kg) with hind limb contraction.

Experimental procedure

The protocols and procedures used in this study were approved by the Animal Ethics Committee of the Lagos State University College of Medicine and conform to the 1985 guidelines for laboratory animal care of the National Institute of Health (NIH).

Each animal was fasted for 18-24 hr before the start of experiment. Anaesthesia was induced by i.v injection of sodium pentobarbitone, 30 mg/kg. Light anaesthesia was maintained with supplemental doses of i.v. sodium pentobarbitone as necessary during dissection. The trachea was intubated using endotrachea tube and the animal was allowed to breathe room air (temp. 25 ^{o}C) spontaneously.

The right femoral vein and artery were cannulated. The cannula in the right femoral vein was moved into an extracorporeal position and a non-crushing clamp was applied to its free end. The left femoral vein was cannulated for the administration of drug and left femoral artery was also cannulated and connected to a two-Channel physiographic recorder through pressure transducer model 7070 Gemini (Ugo Basil) to monitor blood pressure and heart rate. The right femoral nerve was surgically isolated and stimulated by student electrical stimulator (Brooks Instruments, UK) to induce muscular contraction. The output voltage was limited to 5Hz for non-painful muscle contraction for thirty minutes [25]. At the end of the dissection, sodium heparin 300unit per kg-body weight was administered intravenously to prevent blood clotting. After all surgical procedures were completed, a 60-90 minutes stabilization period was observed. The blood flow to the hind limb was measured by timed collection of the blood from the right femoral vein as previously described [26]. Arterial and venous blood samples for glucose estimation were obtained from the cannula placed in the right femoral artery and vein respectively.

Blood pressure was recorded continuously throughout the duration of the experiment. After stabilization, basal measurements of femoral venous blood flow, arterial and venous glucose levels were recorded. Then, these measurements were repeated at 0, 5, 15, 20, 25, 30, 45, 60, 75, and 90 minutes post-injection of drugs. The arterial and venous samples (0.05ml per sample) for glucose determination were obtained simultaneously via three-ways tap cocks placed on the right femoral venous outflow and in the femoral artery cannula. After the basal samples have been taken, the effects of intravenous injection of normal saline, and adenosine under resting (basal) and muscles contractions on the hind limb glucose uptake were studied.

Measurement of blood flow

The technique requires arterial cannulation with an extra corporal circuit with or without a pump. A free flow of blood from the distal end of the right femoral vein cannula into a clear, graduated cylinder was allowed for 30 seconds. The volume of blood thus collected multiplied by two gave flow per minute.

Blood glucose measurement

Blood glucose was determined by modified glucose oxidase method [27]. Glucose uptake was computed as the product of the A-V glucose and blood flow.

Statistical analysis

Data was analyzed using GraphPad Prism version 5.0 statistical software. All values given were expressed as mean ± S.E of the variables measured. Significance was assessed by the student's t-test of two means of independent variables. P values of 0.05 or lesser were taken as statistically significant.

Results

Effects of adenosine (0.1, 0.5 and 1 mg/kg) on blood glucose, arterial-venous (A-V) glucose difference, and hind limb glucose uptake (HGU) in dogs at rest and during contraction

Adenosine produced varying effects on blood glucose, arterial-venous glucose difference and hind limb glucose uptake (HGU). At low doses, (0.1 and 0.5 mg/kg) adenosine has no significant effect on the arterial blood glucose levels when compared with normal saline ($p>0.05$). However, at a high dose of 1.0 mg/kg/min, adenosine produced significant increases in arterial blood glucose levels ($p<0.05$). The effect did not occur until 25min post-injection and was sustained for the rest of the observation period. There was however no significant change in the venous blood glucose levels (table 1).

As shown in Figure 2a, there were dose-dependent increases in A-V glucose following administration of different doses of adenosine when compared to control. Doses of 0.1 and 1 mg/kg/30min of adenosine produced a maximum A-V glucose of about 10.1 mg/dl and 16.3 mg/dl respectively (Fig. 2a) while control was 4.2 ± 0.2 mg/dl (Fig. 1a) [$p<0.05$]. Infusion of adenosine (0.1, 0.5 and l mg/kg) significantly increased blood flow to 8.5 ± 0.2, 12.4 ± 0.3 and 18.5 ± 0.6 respectively from resting blood flow of 4.5 ± 0.5 ml/min (Fig. 1b) [$p<0.05$]. It is to be noted that blood flow to the hind limb during adenosine infusion remains high and sustained throughout the post-infusion observation period (Fig. 2b).

Table 1: Effects of normal saline and intravenous infusion of adenosine (0.1, 0.5, 1 mg/kg) on arterial and venous glucose levels (mg/dl) in dogs at rest.

	Treatment	Time 0	5	10	15	20	25	30	45	60	75	90
Arterial	Control	110±1.4	107±0.9	108±0.8	106±1.9	105±1.2	99±1.0	97±1.4	96±0.9	96±0.8	96±1.0	96±0.4
	Adenosine 0.1mg/kg	99±0.7	94±2.9	88±2.2	89±3.6	93±4.4	92±4.3	97±6.3	98±6.4	96±5.2	96±7.5	97±5.3
	Adenosine 0.5mg/kg	99±1.4	103±6.2	96±8.4	93 ±3.3	89±2.7	89±3.9	92±2.5	92±1.5	92±2.6	92±2.0	91±2.3
	Adenosine 1mg/kg	99±1.2	104±4.0	103±3.0	107±4.4	109±3.3	114±3.7*	113±1.8*	108±3.1	110±3.2	110±1.2	110±2.7
Venous	Control	104±1.5	99±1.7	98±1.1	97±1.2	96±1.5	92±1.4	91±1.2	90±1.6	90±1.4	90±1.6	90±1.7
	Adenosine 0.1mg/kg	95±1.5	77±3.3	74±3.3	77±3.3	79±4.4	80±4.5	82±5.0	80±5.3	77±6.2	76±7.8	79±6.2
	Adenosine 0.5mg/kg	95±1.5	83±2.9	81±5.9	78±2.1	75±3.9	75±2.8	77±1.9	79±1.7	78±1.5	76±2.4	79±6.2
	Adenosine 1mg/kg	95±1.5	89±3.9	90±2.0	89±3.7	91±2.1	92±3.4	97±2.5	96±4.0	91±3.6	95±2.9	65±2.9

*Values are expressed as Mean ± SEM. (N=5) (*p<0.05; **p <0.01 when compared with control)*

Table 2: Effects of normal saline and intravenous infusion of adenosine (1mg/kg) on arterial and venous blood glucose levels (mg/dl) during hind limb muscles contraction in dogs.

	Treatment	Time 0	5	10	15	20	25	30	45	60	75	90
Arterial	Control	99±0.7	118±5.4	115±5.7	128±6.5	110±6.5	109±6.6	107±6.1	104±7.1	105±5.6	106±4.2	105±5.5
	Adenosine	99±2.1	131±2.4*	154±3.2*	160±3.4**	156±4.1**	151±2.5**	156±3.4**	148±5.2**	149±4.6**	149±3.2**	148±2.5**
Venous	Control	95±0.5	94±1.8	94±6.2	96±2.1	98±2.1	98±3.3	92±4.2	94±4.7	93±5.1	93±5.6	93±5.6
	Adenosine	93.2±3.1	115±3.2*	130±3.5**	123±4.3*	123±2.3*	120±3.1*	112±2.1*	108±4.2	109±5.3	109±4.3	109±5.2

Values are expressed as Mean ± SEM. (N=5) (*p<0.05; **p <0.01 when compared with control)

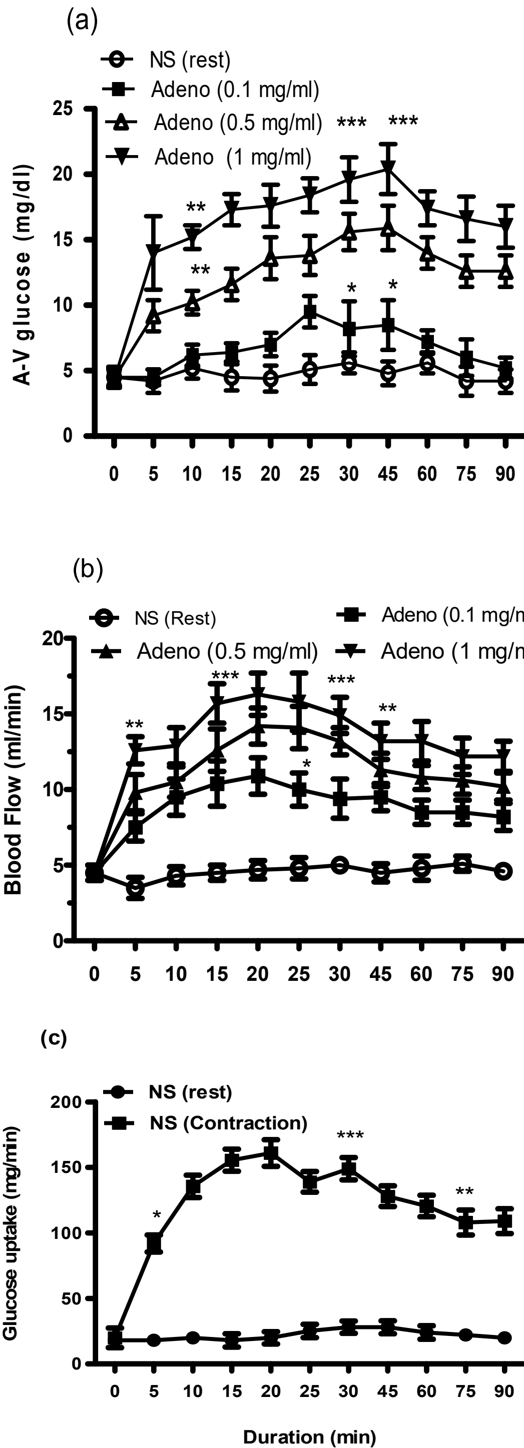

Fig. 1: Effects of intravenous injection of normal saline on (A) arterio-venous glucose (B) blood flow (C) glucose uptake at rest and during hind limb muscle contractions in dogs (n=5). Values are expressed as mean ± SE (**P*< 0.05; ***P*<0.01; ****P*<0.001).

At rest the hind limb glucose uptake (HGU) in the dogs was 18.0 ± 1.5 mg/min and was sustained following administration of normal saline (Fig. 1c). However, adenosine produced dose-dependent increases in HGU. The HGU increased from 18.0.0

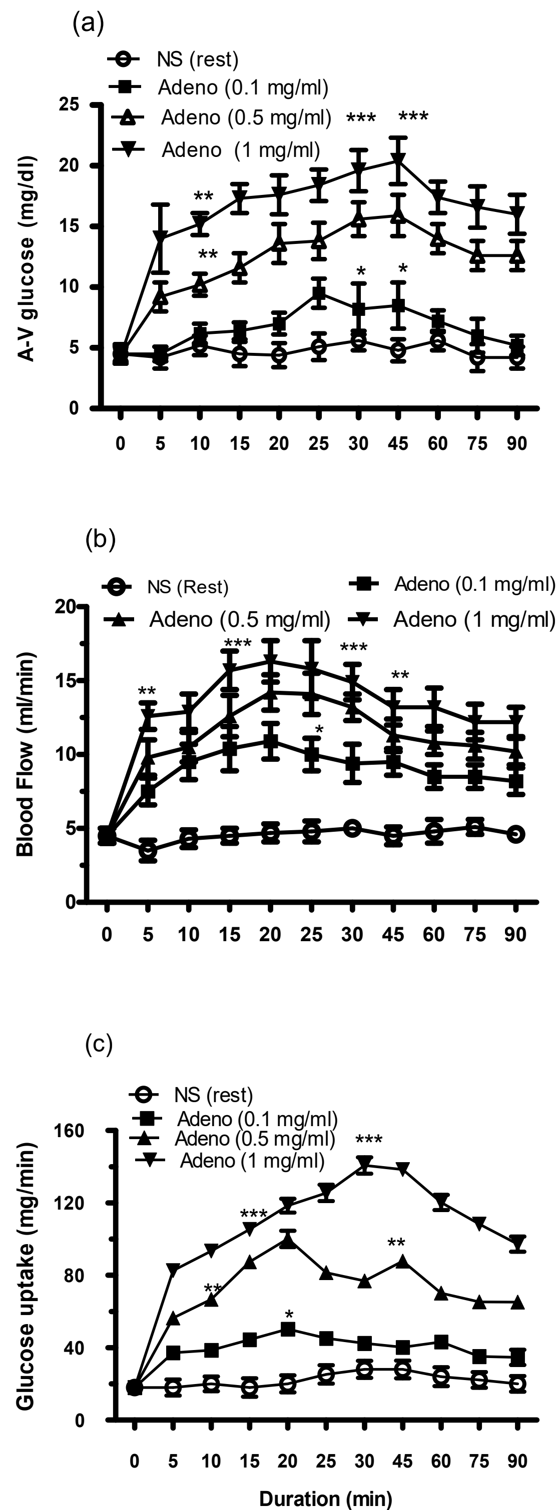

Fig. 2 : Effects of intravenous injection of normal saline and intravenous infusion of adenosine (0.1; 0.5; and 1mg/ ml) on (A) arterio-venous glucose (B) blood flow (C) glucose uptake at rest in dogs (n=5). Values are expressed as mean ± SE (**P*< 0.05; ***P*<0.01; ****P*<0.001).

± 0.5mg/min to 50.3 ± 2.5 mg/min, 100.1 ± 4.5 mg/ min and 140.7 ± 4.4 mg/min for 0.1, 0.5 and 1.0 mg/ kg/30min respectively [p<0.05] (Fig. 2c).

Table 2 shows the effect of contraction of the hind limb on arterial and venous blood glucose level. Contraction and infusion of adenosine (1 mg/kg/min) caused significant ($p<0.05$) increase in both arterial and venous glucose levels of the hind limb. (Table 2).

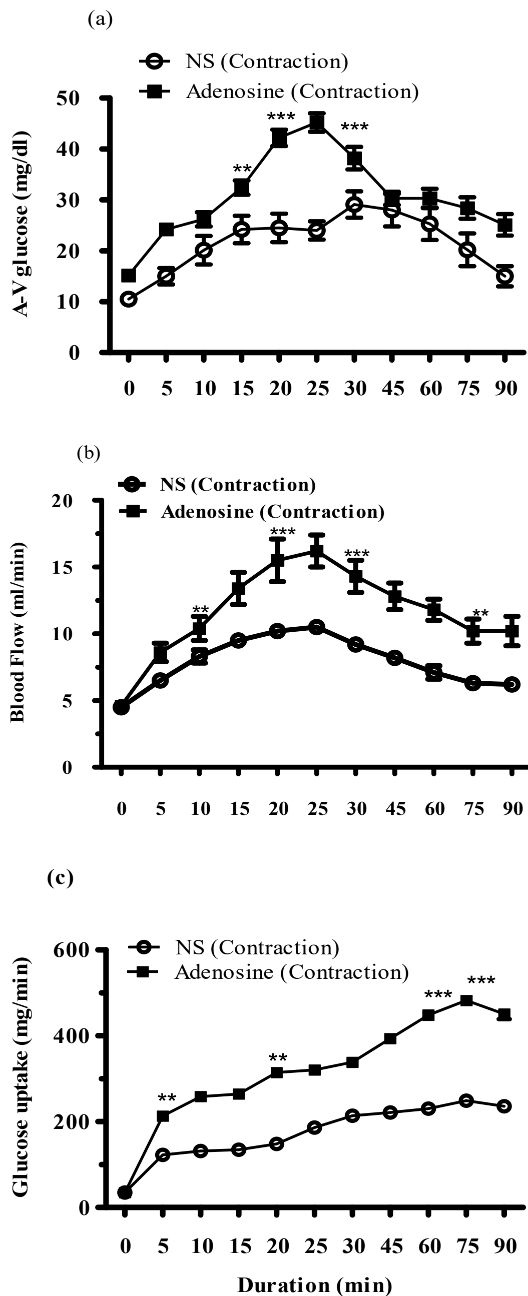

Fig 3: : Effects of intravenous infusion of adenosine (1mg/ml) on (A) arterio-venous glucose (B) blood flow (C) glucose uptake at hind limb during contraction in dogs (n=5). Values are expressed as mean ± SE (*P< 0.05; **P<0.01; ***P<0.001).

Figure 1a shows the effect of hind limb contraction on A-V glucose difference. There was a steady rise in A-V glucose, from 4.5 ± 0.7 mg/dl reaching its peak at 29.1 ± 2.6 mg/dl about 30 mins into the contraction period. Administration of adenosine significantly increased A-V glucose higher than normal saline in contracting hind limb [$p<0.05$] (figure 3a).

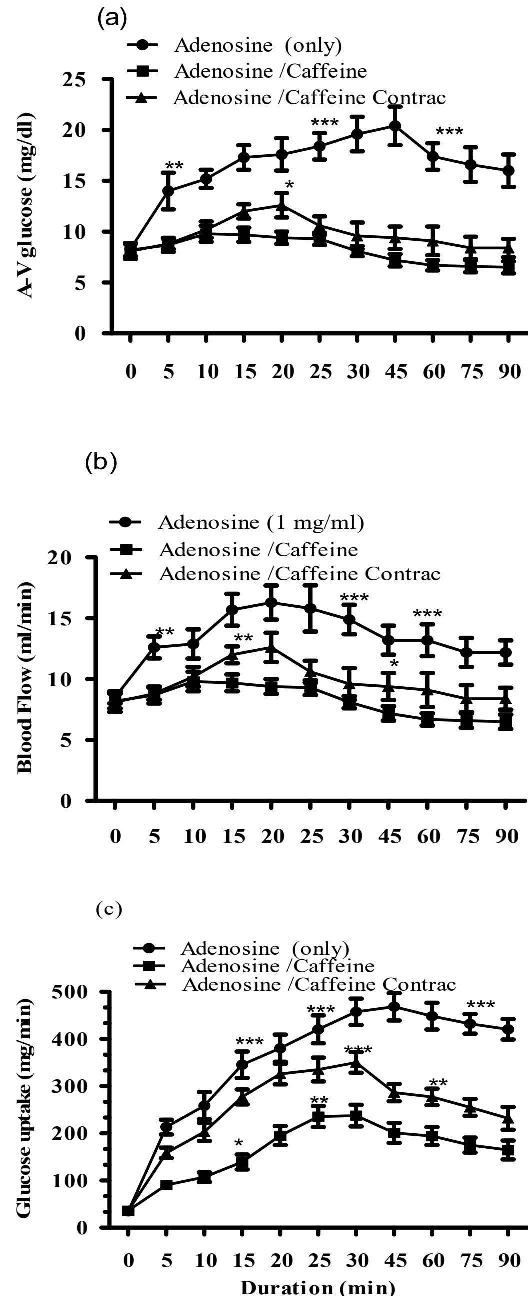

Fig. 4: : Effects of intravenous infusion of adenosine (1mg/ml) on (A) arterio-venous glucose (B) blood flow (C) glucose uptake in hind limb pre-treated with caffeine (6mg/ml) at rest and during hind limb contraction in dogs (n=5). Values are expressed as mean ± SE (*P< 0.05; **P<0.01; ***P<0.001).

Following contraction, the blood flow to the hind limb significantly increased from 4.5 ± 0.5 ml/mins to 13.2 ± 0.6 ml/mins. This was sustained throughout the contraction and post contraction period (Fig. 1b).

Table 3: Effects of intravenous infusion of adenosine (1mg/kg) on arterial and venous glucose levels (mg/dl) at rest and during hind limb contraction in non-caffeine and caffeine (6mg/kg) pre-treated dogs.

		Time										
	Treatment	0	5	10	15	20	25	30	45	60	75	90
Arterial	Adenosine only (Rest)	95±1.2	115±4.0	126±3.0	132±4.4	123±3.3	121±3.7	121±1.8	120±3.1	126±3.2	120±1.2	118±1.2
	Adenosine+Caffeine (Rest)	99.3±1.2	104.4±4.0	102.6±3.0	107.4±4.4	108.6±3.3*	113.8±3.7	113.4±1.8	108±3.1	109.6±3.2	110.2±1.2	110.2±2.7
	Adenosine only (Contraction)	99±2.1	131±2.4*	154±3.2*	160±3.4***	156±4.1***	151±2.5**	156±3.4**	148±5.2**	149±4.6**	149±3.2**	148±2.5**
	Adenosine+Caffeine (Contraction)	98±0.5	128±1.8*	130±2.0*	133±1.5**	134±2.1**	134±1.2**	132±1.2**	131±2.2**	126±2.4**	118±2.1**	118±1.2*
Venous	Adenosine only (Rest)	94±2.3	109±3.1	115±4.3	118±5.2	120±4.7	116±5.2	107±3.2	104±3.2	105±3.2	106±4.2	105±3.2
	Adenosine+Caffeine (Rest)	95.6±6.0	89.4±3.3	89.6±2.0	88.6±3.7	91.4±2.1	92.2±3.4	96.6±2.5	95.8±3.7	91.2±4.0	95.4±3.6	95.4±2.9
	Adenosine only (Contraction)	93.2±3.1	115±3.2	130±3.5	123±4.3	123±2.3	120±3.1	112±2.1	108±4.2	109±5.3	109±4.3	109±5.2
	Adenosine+Caffeine (Contraction)	95±0.6	102±1.2*	100±1.1*	100±1.2*	97.4±2.5	99.6±1.2	105±±2.5	105±1.2	103±0.5	100±1.2	100±1.7

Values are expressed as Mean ± SEM. (N=5) (*p<0.05; **p<0.01; ***p<0.001 when compared with control)

During contraction adenosine significantly increased the blood flow to the hind limb compared to control (Fig. 3b) [$p<0.05$].

The effect of contraction of the hind limb on glucose uptake is shown in Figure 1c. In normal saline-treated animals, HGU significantly increased during contraction ($p<0.05$) but remained steady at rest. It is to be noted that in the post-contraction observation period HGU did not return to the basal level. During contraction treatment with adenosine also significantly increased HGU higher than that of normal saline ($p<0.05$). (Fig. 3c).

Effect of adenosine on blood glucose, A-V glucose, and hind limb glucose uptake (HGU) in caffeine-treated dogs at rest and during contraction

Pre-treatment with caffeine significantly reduced hyperglycemia induced by adenosine infusion at rest and during contraction compared to non- caffeine treated group (table 3) and also significantly inhibit A-V glucose differences (Fig. 4a).

Figure 4b shows the effect of adenosine on blood flow in dogs pretreated with caffeine. Caffeine significantly reduced adenosine induced increase in blood flow to the hind limb. As shown in figure 4c, pretreatment with caffeine significantly reduced the effect of adenosine on glucose uptake.

During pre-treatment with caffeine, there was also significant increase in A-V glucose during contraction compared to control [$p<0.05$] (Fig 4a). Figure 4b shows the effect of adenosine on blood flow in caffeine pre-treated dogs during contraction. Pre-treatment with caffeine reduced significantly the effect of adenosine on blood flow during contraction of the hind limb ($p<0.05$). Pre-treatment of the animal with caffeine also reduced significantly the glucose uptake. For instance, caffeine pretreatment decreased hind limb glucose uptake from 420.7 ± 2.3 mg/min to 231.8 ± 3.7 mg/min (a decrease of about 44.9%) during contraction of the hind limb ($p<0.05$).

Discussion

The present study examined the effects of exogenously administered adenosine on arterial-venous (A-V) glucose, venous blood flow and hind limb glucose uptake (HGU) during resting and contraction states in experimental dogs. The observed increase in blood flow following the contraction of the hind limb in this study agrees with the report of Hespel et al. [28]. It is also consistent with previous reports [3,4], whereby exercise-induced contraction was reported to increase blood flow probably through recruitment of capillaries with increase surface area for glucose delivery and exchange in rats and humans [29,30]. Hind limb contraction induced increase in muscle A-V glucose difference and glucose uptake. This is consistent with the reports of many other studies [28, 31]. The increase in A-V glucose observed in the present study showed that muscular contraction increased glucose extraction by the canine hind limb. This may be partially due to the increase in blood flow or probably due to the increase in blood glucose levels, since the arterial glucose level is the other important determinant of muscle glucose uptake during contraction.

The molecular signaling mechanisms by which contraction/exercise induced glucose uptake are not fully understood. However, it is proposed that the rise in intracellular Ca^{2+} is a mediator of increased glucose transport during skeletal muscle contraction and hypoxia. This was based on the evidence that hypoxia, verapamil, a calcium inhibitor or dantrolene which lower Ca^{2+} efflux from sarcoplasmic reticulum inhibit glucose transporter during skeletal muscle contraction. In addition, agents that increase the cytoplasmic Ca^{2+} such as caffeine and Ca^{2+} ionophores may activate the glucose transporter [32,33]. Therefore, the increase in the intracellular calcium may facilitate the activation of key intracellular signaling molecules that increased muscle transporter. Ca^{2+} are also known to activate conventional protein kinase (cPKC) and Phorbol 12-myristate 13-acetate (PMA) an activator of cPKC are reported to increase glucose disposal by distinct mechanism from insulin [32-34]. In this study, the significant increase in blood flow and glucose uptake to the hind limb observed with exogenous infusion of adenosine at rest is similar to the observation in similar study [35]. Heinomen et al. [36] reported that adenosine infusion at rest increased glucose uptake by several-fold in healthy young men [36], and in patients with essential hypertension [37]. Reports also observed that the increase in forearm glucose uptake by adenosine infusion was not insulin-mediated [38] since the observed glucose uptake was inhibited in the present of adenosine receptor antagonist [39]. Also reports indicate that adenosine action via the A_1 adenosine receptor activates and regulates both insulin- and contraction-induced glucose uptake [39,40]. In contrast, absence of the receptor decreases glucose transport in both situations [41]. The presence of adenosine receptors in skeletal muscle have been well documented [11,20]. Earlier report indicates that the resting and contraction adenosine concentrations in dog model are similar to those of humans [42]. Reports indicate that exogenous administration of

adenosine stimulate the formation of nitric oxide and prostacyclin in both the intravascular and interstitial compartments of skeletal muscle [43,44]. Nitric oxide and prostacyclin have been shown to contribute to the exercise hyperaemia response [44,45] which suggest that about two thirds of the vasodilator response to adenosine during muscle contraction may be mediated through the formation of nitric oxide and prostacyclin. Therefore, the observed increase in blood flow and glucose uptake in this study may be due in part to the effect of adenosine on NO production since NO has been shown to increase glucose uptake [45].

Furthermore, the significant inhibiting effect of caffeine on the exogenous adenosine at rest and during contraction on blood flow and glucose uptake is of interest. After extensive search of literature, there was no reported work on the inhibiting effects of caffeine on exogenous adenosine actions on blood glucose in dog. One study in humans showed that caffeine impaired insulin sensitivity and glucose uptake [46]. This effect was attributed to increased plasma epinephrine and free fatty acid levels rather than peripheral adenosine receptor antagonism. In contrast other studies suggesting that endogenous adenosine may modulate muscle glucose uptake during muscle contraction have been conducted in rats [41,47]. Although we did not measure plasma levels of cathecholamines in this study, previous study have shown that adenosine reduces catecholamine mediated activation of phosphorylase by inhibiting beta receptor adenylate cyclase coupling [48]. In animal study, caffeine stimulates the release of cathecholamines to enhance contraction-induced glycogenolysis [40] by inhibition of phosphodiesterase, and increasing cAMP, [13]. There are also studies that showed that caffeine decreases insulin sensitivity through the blockage of adenosine receptors [13,20]. Therefore, the significant reduction in hind limb blood flow and glucose uptake in caffeine pretreated group observed in this study is also consistent with the reported vasoconstriction effect of caffeine [49]. The possible explanation for the vasoconstriction effect of caffeine is the blockage of vasodilatory actions of adenosine receptors [50].

In conclusion, there were several important findings in the present study. Firstly, we observed that moderate electrical stimulation led to increase in blood flow and glucose uptake in contracting canine hind limb. Secondly, exogenous infusion of adenosine increased blood flow and glucose uptake at rest and during contraction of canine hind limb. Thirdly, inhibition of adenosine action by caffeine significantly affect glucose uptake in canine hind limb at rest and during contraction. The mechanism regulating skeletal muscle glucose uptake during contraction is complex and could be mediated directly via adenosine receptors.

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Family violence: A cause of sight threatening eye injuries in Ibadan, Southwest Nigeria.

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Abstract

Background: Eye injuries cause significant ocular morbidity in general ophthalmic practice, and reports, suggest that majority of these injuries occur at home. Eye injuries within the home may result from accidental and non-accidental injury. While accidental ocular trauma is well recognized and often promptly reported, non-accidental ocular trauma may be harder to identify. Non-accidental domestic eye injuries often result from interpersonal violence within the home; otherwise known as "*family* violence". Corporal punishment, a common practice in the African setting, accounts for a significant number of non-accidental domestic eye injuries.
Aim: This article seeks to draw attention to interpersonal violence within the home, as an important cause of avoidable ocular injuries and to sensitize physicians, to the need for multidisciplinary management and social intervention.
Methods: This was a five-year review of eye injuries that occurred at home. Cases resulting from non-accidental injury inflicted by a relative or family member were included. Demographic data regarding the injured cases, and their assailants, was collected. Ocular presentation, presenting visual acuities, and final visual outcomes were analyzed.
Results: One hundred thirty-eight eye injuries were reviewed. Of these, 57.2% (79/ 138) occurred at home. Interpersonal violence, accounted for 16 out of the 79 domestic eye injuries, comprising 5 males and 11 females. Nearly half (7/16) of the injuries, resulted from corporal punishment. Patients were aged 10-45 years (mean 23.8 years). Patients presented, on average, 5.5 days post-injury. Visual outcome was generally poor.
Conclusion: Spousal and child abuse are under-recognized causes of eye injuries in the home.

Keywords: *Violence, Home, Eye injuries, avoidable blindness, corporal punishment, child abuse*

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Résumé

Contexte: Les lésions oculaires causent une morbidité oculaire importante dans la pratique ophtalmologique générale, et les rapports suggèrent que la majorité de ces blessures se produisent à la maison. Les lésions oculaires dans la maison peuvent résulter de blessures accidentelles et non accidentelles. Tandis que le traumatisme oculaire accidentel est bien reconnu et souvent signalé rapidement, le traumatisme oculaire non accidentel peut être plus difficile à identifier. Les lésions oculaires domestiques non accidentelles résultent souvent de la violence interpersonnelle à l'intérieur du foyer; autrement connu sous le nom de "violence familiale". Le châtiment corporel, une pratique courante dans le milieu africain, représente un nombre important de blessures oculaires domestiques non accidentelles.
Objectif: Cet article cherche à attirer l'attention sur la violence interpersonnelle au foyer, comme une cause importante de blessures oculaires évitables et pour sensibiliser les médecins, à la nécessité d'une gestion multidisciplinaire et d'une intervention sociale.
Méthodes: Il s'agissait d'un examen quinquennal de lésions oculaires survenues à la maison. Les cas résultant d'une blessure non accidentelle infligée par un parent ou un membre de la famille ont été inclus. Les données démographiques concernant les cas blessés et leurs agresseurs ont été recueillies. La présentation oculaire, la présentation de l'acuité visuelle et les résultats visuels finaux ont été analysés.
Résultats: Cent trente-huit blessures des yeux ont été examinées. Parmi ceux-ci, 57,2% (79/138) se sont produits à la maison. La violence interpersonnelle représentait 16 des 79 blessés dentaires domestiques, dont 5 hommes et 11 femmes. Près de la moitié (7/ 16) des blessures ont résulté de châtiments corporels. Les patients étaient âgés de 10 à 45 ans (moyenne de 23,8 ans). Les patients ont présenté, en moyenne, 5,5 jours après la blessure. Le résultat visuel était généralement médiocre.
Conclusion: La violence faite au conjoint et aux enfants sont des causes insuffisamment reconnues des lésions oculaires dans la maison.

Mots-clés: *Violence, Maison, Lésions oculaires, aveuglement évitable, châtiment corporel, maltraitance des enfants*

Introduction

Eye injuries are a significant cause of ocular morbidity in general ophthalmic practice and reports suggest that majority of these injuries occur at home [1]. Eye injuries within the home may result from accidental and non-accidental injury [1,2]. While accidental ocular trauma is well recognized and often promptly reported, non-accidental ocular trauma may be harder to identify. Non-accidental domestic eye injuries may result from interpersonal violence within the home; otherwise known as "*family* violence or *domestic violence*". Family violence (FV), is a broad term, encompassing "*intimate partner* or *spousal violence*", "*gender violence*", "*violence against women*" as well as *"physical violence against children"* otherwise known as *"child abuse"*[3]. While on the other hand, domestic violence (DV), conventionally, is used as a more restrictive term limited to *spousal* or *intimate partner violence* [3-7]. Notwithstanding, less recognized or emphasized forms of violence within the home do exist and indeed, may be responsible for significant ocular morbidity and avoidable blindness. Family violence (FV) refers to acts of violence between family members or intimate relations including elders, children and caretakers [3]. The term family violence is sometimes used interchangeably with domestic violence (DV); which is defined as the use of physical or non- physical means to control or maintain family members or persons living in an intimate relationship within a household in an abusive or coercive relationship for the benefit of the abuser [3]. Family violence is a broad term encompassing ***any*** form of interpersonal violence that occurs between members of a household; irrespective of the relationship [3, 4]. Naturally, the concept of FV is abhorred among many cultures however, it remains highly prevalent in some societies, and is even tolerated by others; existing in different forms of traditionally acceptable cultural practices, such as wife-beating, child-beating (corporal punishment) and verbal abuse, perpetrated in the course of enforcing discipline within the home [5-9]. There is significant under-reporting of all forms of FV because of the associated stigma and fear of reprisal, reproach or rebuff [7, 10]. The impact of FV is therefore significantly underestimated.

The objective of this study, therefore, was to investigate the impact of interpersonal violence as a cause of non-accidental eye trauma within the home. This article seeks to draw attention to the different forms of interpersonal violence within the home, as an important cause of avoidable ocular injuries presenting to the emergency ophthalmology department and to sensitize physicians, to the need to establish a standard operating procedure (protocol) for the multidisciplinary management of non-accidental eye injuries resulting from violence within the home. This protocol should address not only the management of the ophthalmic injury, but also seek to identify and address sociocultural factors that predisposed to it.

Materials and methods

All eye emergency case records in the Department of Ophthalmology, University College Hospital, Ibadan, from 31st July 2006 to 30th September 2011 were retrospectively reviewed for documentation of ocular injuries, which occurred, as a result of violence within the home. Data extracted from clinical records included: age, sex, occupation, home address, nature of home location (whether urban or rural), level of education, details of assailant, circumstances of the eye injury, patient's relationship to the assailant and the nature of any objects involved. Examination findings were reviewed and injuries were classified and graded in severity using Birmingham Eye Trauma Terminology System (BETTS), [11] time of presentation to hospital, time lag between injury and presentation was calculated and reasons for delay were identified. Other data retrieved were visual acuity at presentation, clinical diagnosis, treatment received, final visual outcome and duration of follow-up visits.

Family violence was defined as any record of assault occurring between two or more members of a nuclear or extended family. Therefore any record of ocular injury resulting from assault by a household member or relation, which occurred within the home, was enrolled in this study as a case of family violence.

All cases of eye trauma, occurring within or around the home, in the course of any intentional act of violence involving the patient, and perpetrated by members of the individuals' household; were included in this study. Other home-related accidents and ocular injury caused by non-family members such as burglars and other strangers as well as ocular injuries that occurred away from the home location were excluded.

Results

During the period under review, a total of 138 cases of ocular injuries reported to the eye emergency room. Seventy- nine (57.2%), of these ocular injuries had occurred within the home setting, and these were identified. Family violence accounted for 16 out of these 79 (20.3%) ocular injuries. The ages of FV victims, ranged from 10 – 45 years with an average of 23.8 years.

Table 1: Clinical characteristics of patients presenting with eye injuries related to interpersonal violence within the home

Age (victim's age in yrs)	Sex (victim)	Injured Eye	Circumstance	Assailant (relationship to patient)	Agent causing injury (physical agent used)	Presenting acuity (injured eye)	Time lag (Time between injury and clinic presentation)	Final acuity (injured eye, VA last visit)	Follow-up (Comments)
26	F	Right	Fight	Husband	Broken bottle (stabbing)	NLP	6 days	NLP	1 month
10	M	Left	Corporal punishment	N/A	Cane	6/60	4 days	6/24	6 weeks
10	M	Left	Corporal punishment	N/A	Cane	LP	4 days	6/60	8 months
45	M	Right	Fight (bystander injury)	Brother	Fist (punch)	LP	6 days	NLP	2months
36	F	Right	Fight	Brother	Fist	NLP	5 hours	NLP	lost to follow-up. 3 days
15	M	Left	Corporal punishment	Uncle	Cane	CF	14 days	CF	Discharged against medical advice, same day
11	F	Left	Corporal punishment	Uncle	Belt	NLP	14 days	NLP	lost to follow-up. 52 days post-surgery
13	F	Left	Corporal punishment	Step-mother	Cane/ stick	6/18	9 days	6/12	lost to follow up. 6 days
12	F	Right	Corporal punishment	Mistress/ guardian	Cane/ stick	6/9	3 days	6/24	lost to follow up. 6 days
14	F	Right	Corporal punishment	Uncle	Comb	LP	4 days	LP	Lost to follow-up, same day (presented with traumatic cataract)
24	F	Right	Fight	Husband	Kick	6/9	1 day	6/5	Lost to follow-up. same day
34	F	Left	Argument	Brother	Slap	6/6	5 days	6/5	4 days
40	F	Both	Fight	Husband	Fist	6/5	2days	6/5	1 week. reviewed at 6 months
30	F	Right	Fight	Husband	Slap	6/9	7 days	6/9	Lost to follow-up. same day
27	F	Left	Fight	Husband	Fist	6/5	3 days	6/5	3 weeks
53	M	Right	Argument	Wife	Knife (Stabbing)	NLP	5 hours	NLP	2 weeks. developed lid contractures, phthisis bulbi following surgical repair

Table 1 shows the clinical characteristics of patients presenting with eye injuries related to interpersonal violence within the home. There were 5 males and 11 females. According to the BETTS classification, there were 9 closed globe injuries, resulting from contusion of the globe, 1 open globe injury from penetrating eye trauma, 1-ruptured globe and 3 cases with mixed injuries. Figure 1 is a pie chart showing the types of agents involved in causing the ocular injury in the 16 cases. Right and left eyes were affected with comparable frequency. Ocular injury to the right eye occurred in 8 cases, and in the left eye in 7 cases, while both eyes were affected in one patient.

Circumstances surrounding the injury were also analyzed. Injury was sustained in a fight or argument in the majority of cases; occurring in 9/16 patients; of these, one patient had not been directly involved in the argument, but was a bystander. A "fight" was defined as any altercation involving 2 or more individuals and involving the use of physical contact from the onset. An "argument" was defined as any altercation between 2 or more individuals involving the exchange of words at the onset.

The remaining 7/16 patients sustained injury as a result of some form of corporal punishment. "Corporal punishment" was defined as physical contact meted out to an individual of younger age or lesser social standing as a means of enforcing discipline or as punishment for wrongdoing as expressed by the perpetrator. This was obtained from the history at presentation.

The assailants (perpetrators) were most often male (11/16 cases), and female in only 3/16 cases. The gender of the assailant was not documented in 2 cases. The relationships of the assailants to the victims are also highlighted in table 1. In the single case where the assailant of a man was his wife, the eye injury was inflicted with a kitchen knife. This was the most severe of all the eye injuries seen in this study. Figure 1 shows the almost unrecognizable globe and full-thickness upper and lower eyelid lacerations at surgery.

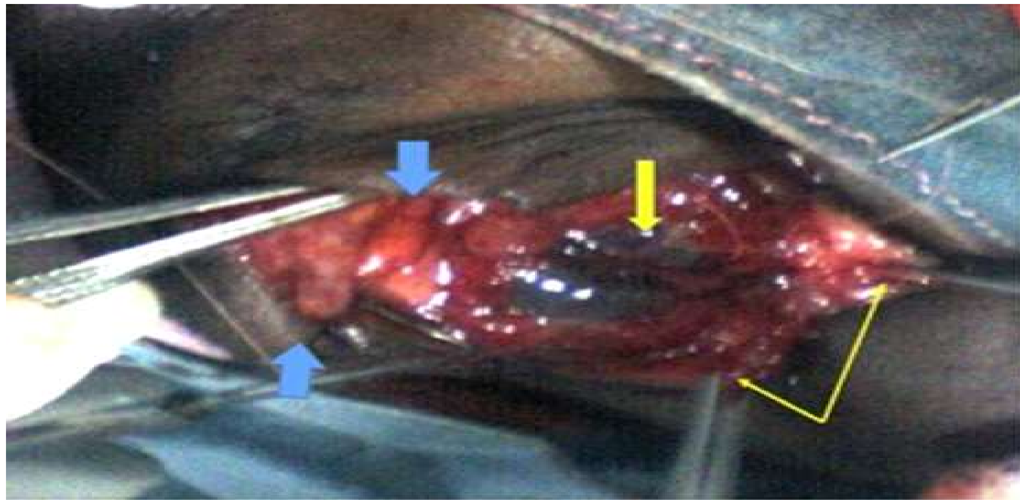

Fig.1: Knife injury to right eye (patient 16) with full thickness upper and lower lid lacerations (identified with forceps) and extensive corneo-scleral laceration to equator above and below (eye is totally disfigured)

The time lag between injury and presentation to the emergency room varied widely and ranged from as little as 3 hours after trauma to as long as 2 weeks after injury with an average of 5.5days (median of 4.5 days). The commonest reason for delay was an attempt to seek an alternative to hospital care, which was the situation in 10 of the 16 cases. Only 4 patients presented 'without delay' i.e. within 24 hours. The reason for delay was not stated in two cases.

Ten patients presented with severe loss of vision in the affected eye (vision <6/18). Eight of these patients presented with vision in the range of legal blindness (i.e. counting fingers, hand movement, light perception or no light perception), while 2 patients presented with low vision (i.e. visual acuity between 6/18 and 6/60). Only 6 of the 16 patients had good vision in the affected eye at presentation.

Four patients required surgery, for repair of a globe rupture or corneal laceration. All four patients

presented with vision between light perception and NPL. The remainder (12/16) had conservative treatment with topical steroids, antibiotics and cycloplegics.

Follow-up by patients was generally poor, with 10/16 patients becoming lost to follow up within a week. Only 6 patients returned for review 1 month or more after first presentation.

The visual acuity at the last clinic attendance was poor in half of the cases; with severe visual loss in half (8/16) of the patients. Vision at presentation is tabulated against final visual outcome and the agent causing injury in table 1.

Table 2.:

Source/Mechanism of injury	No. of cases
Hand/fist (slapping, punching)	6
Cane (whipping)	5
Knife (stabbing)	1
Comb	1
Foot (Kicking)	1
Bottle (stabbing)	1
Belt	1
Total	16

Discussion

Domestic eye injuries constitute a significant proportion of all ocular emergencies. More than half of the annual burdens of eye injuries, worldwide, have been reported to occur in and around the home [9]. Global estimates report that 1.6 million people become bilaterally blind worldwide, from injuries, every year; and a further 19 million are left with unilateral blindness or low vision [9]. While the home is clearly identified as a significant location for eye injuries,[10,12-13] the impact of violence within the home (FV), on the prevalence of eye injuries, has not been specifically emphasized. Consequently, *physical violence against children*, such as 'unrestrained' corporal punishment, is an under-recognized form of "domestic" violence. While the international spotlight has been shining on spousal and intimate partner violence for many decades, less attention has been drawn to this other aspect of violence within the home. Corporal punishment is generally accepted and practiced in the traditional African setting. However, severe eye injuries, resulting from such corporal punishment, do occur and have not received sufficient attention. A recent review of ocular injuries presenting to the University College Hospital showed that 58% of eye injuries occurred in the home setting [13].

Similarly, in this study, 79 of 138 cases, representing 57.2% of the total, had sustained eye injuries at home. However, the nature of domestic injuries in Ibadan has not previously been analyzed in detail. Family violence has been shown to be prevalent, but is still underreported, in the Nigerian society, mostly for fear of stigmatization [6, 7, 16]. Reporting of spousal violence experienced by men in the Nigerian society is even rarer [16]. Violence within the home can therefore easily be missed, if inquiries into the circumstances surrounding domestic injuries are not specifically made [17]. This study seeks to enlighten healthcare workers in general and ophthalmologists in particular, that domestic violence and child abuse causing eye injuries, clearly exists in the Nigerian environment, and these injuries can be severe and even sight-threatening. While spousal or intimate partner violence, is the most advertised cause of family violence in literature [3, 6, 16, 18-20] in this study, spousal violence was second only to corporal punishment as the commonest reported form of interpersonal violence, within the home. Similar to reports in literature, the perpetrators were mostly male [10, 21] and the fist/hand was most often used [20]. It is noteworthy, that the single case of spousal attack, in which the victim was the husband, appeared to be the most violent attack and involved stabbing of the eye through the lids, with a kitchen knife. This appears to support the theory that although women are more likely victims of intimate partner violence, they tend to use more physical aggression towards their male victims, as perpetrators [22]. In a report by Mechem *et al*. 37% of female perpetrators used weapons in the course of intimate partner violence, however most weapons were used in self-defense or in retaliation for a previous abuse [23]. It is not unlikely that this may have been the case in this instance.

Corporal punishment is a time-honored practice in the traditional African setting [5, 8, 24]. However, unbridled corporal punishment must be recognized as violence against the child and therefore understood as a form of child abuse [25, 26].

Family violence appears to be an unrecognized cause of preventable blindness in children and young adults in the developing countries and interventions aimed at reducing the impact of interpersonal violence within the home should revolve around health education and awareness campaigns focused on changing harmful beliefs and traditional practices [2, 9, 21, 27-29]. In this study, 3 out of every 4 cases presented late (>24 hours), with only 1 in 4 cases reporting to the emergency facility within 24 hours of injury. Almost all had tried

some alternative medication or strategy to avoid hospital care and had only resorted to the emergency room when all else failed. The delay in presentation combined with the severity of the eye injuries was compounded by failure to maintain adequate follow up; leading to universally poor outcome of treatment observed in this study. The most effective strategy to reduce the impact of family violence on preventable eye injuries would therefore be the prevention of family violence itself, through education of the health care worker and public campaign against interpersonal violence within the home [3, 5, 30]. The health worker must cultivate a high index of suspicion, and provide full documentation as well as appropriate social service referrals when cases are identified [17, 31]. Institutions must develop and provide clear guidelines for attending physicians and paramedical staff, which will serve as a Standard Operating Procedure (SOP) for the multidisciplinary management of victims of family violence; that incorporates counseling and follow-up services [31].

While corporal punishment may have demonstrated some historical usefulness in enforcing discipline in African homes, there must be a campaign to create awareness of the detrimental effects of reckless use of force and unbridled physical punishment [29]. There have been sporadic reports, which highlighted corporal punishment as a cause of ocular trauma among children in Nigeria, [2, 24, 25,32,33] however, this has neither driven legislation, nor has it received adequate attention in the media. Corporal punishment resulting in physical disability or permanent disfigurement should be discouraged, recognized, and treated, as child abuse, and there should be legislation to uphold and protect the rights of the *minor* in such circumstances [29, 34].

There is also an acute need for both regional and national eye trauma registries in Nigeria, to facilitate the monitoring of ocular trauma statistics for planning and public policy formulation. Primary prevention should be engineered through social reorientation towards less harmful methods of child discipline, which can be encouraged through health education and active media campaigns.

Conclusion

This information should raise the awareness of ophthalmologists to the need for a comprehensive approach to the management of eye trauma resulting from violence within the home, as the ophthalmologist may be the first and only physician to identify these cases of family violence, and should be in a position to provide holistic management and appropriate referral of victims. There is also a need for social reorientation to the concepts of corporal punishment and child abuse. The need for regional and national eye injury registries cannot be overemphasized.

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Determination of the levels of some heavy metals in industrial workers

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Abstract
Background: Heavy metals are the major sources of globally distributed pollutants in our environment and account for substantial portion of many disorders in the body. This study investigated the levels of some heavy metals; mercury (Hg), lead (Pb), cadmium (Cd) and arsenic (As) as well as assessed the kidney and liver function tests in industrial workers who have been occupationally exposed.
Method: Six millimeters of blood specimen were collected into non-anticoagulant bottles from a total number of 111 participants (industrial workers and control subjects). The participants were grouped into Groups 1, 2, 3 and control. The heavy metals (Hg, Pd, As and Cd) were analyzed using atomic absorption spectrophotometer. Serum urea, creatinine, alkaline phosphatase, aspartate amino transferase, alanine amino transferase, conjugated bilirubin and total bilirubin were determined using spectrophotometric methods.
Results: The results showed significant increases ($p<0.05$) in the levels of the heavy metals in the industrial workers compared with that of control. The mean levels of Pb in Groups 1,2, and 3 were 15.81 ±6.00, 17.53 ±5.20, 19.40± 4.40 respectively compared with the control (4.20± 2.40). These levels of Pb are higher than the levels set by the Agency for Toxic Substance and Disease Registry and Center for Disease Control (10 µg/dl).
Conclusion: It was concluded that chronic exposure to these heavy metals may predispose the industrial workers to serious adverse health effects.

Keywords: *Heavy metals, lead, mercury, arsenic, cadmium*

Résumé
Contexte: Les métaux lourds sont les principales sources de polluants distribués mondialement dans notre environnement et représentent une partie substantielle de nombreux troubles dans le corps. Cette étude a étudié les niveaux de certains métaux lourds; Le mercure (Hg), le plomb (Pb), le cadmium (Cd) et l'arsenic (As) ainsi que l'évaluation des tests de la fonction rénale et hépatique chez les travailleurs industriels qui ont été exposés au travail.
Méthode: Six millimètres d'échantillons de sang ont été recueillis dans des bouteilles non anticoagulantes d'un nombre total de 111 participants (travailleurs industriels et sujets témoins). Les participants ont été regroupés en groupe 1, 2, 3 et contrôle. Les métaux lourds (Hg, Pd, As et Cd) ont été analysés en utilisant un spectrophotomètre à absorption atomique. L'urée sérique, la créatinine, la phosphatase alcaline, l'aspartate amino-transférase, l'alanine amino-transférase, la bilirubine conjuguée et la bilirubine totale ont été déterminées à l'aide des méthodes spectrophotométries.
Résultats: Les résultats ont montré des augmentations significatives (p <0,05) dans les niveaux des métaux lourds chez les travailleurs industriels par rapport à ceux du contrôle. Les niveaux moyens de Pb dans les groupes 1,2 et 3 étaient 15,81 ± 6,00, 17,53 ± 5,20, 19,40 ± 4,40 respectivement par rapport au témoin (4,20 ± 2,40). Ces niveaux de Pb sont supérieurs aux niveaux fixés par l'Agence pour les Substances Toxiques et le Registre des Maladies et le Centre de Contrôle des Maladies (10 µg/dl).
Conclusion: On a conclu que l'exposition chronique à ces métaux lourds pourrait prédisposer les travailleurs industriels à des effets néfastes graves sur la santé.

Mots-clés: *Métaux lourds, plomb, mercure, arsenic, cadmium*

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Introduction
Heavy metals are the major category of globally distributed pollutants in our environment and they cause serious health effects such as reduced growth rate and development, cancer, organ damage, nervous system damage etc. Heavy metal poisoning could result from drinking contaminated water; for instance water from lead pipes [1]. Possible exposures to these metals have resulted in health problems [2]. However, for the maximum protection of human health, the Centre for Disease Control and Agency for toxic Substance and Disease Registry have set a reference value for the exposure to these metals. Lead $\leq$ 10µg/dl, mercury $\leq$0.8µg/dl, cadmium $\leq$ 0.5µg/dl and arsenic $\leq$ 0.01µg/dl [3,4]. Thus, exposure to these

heavy metals above the reference value is liable for causing serious health effects. Lead has been shown to interfere with DNA transcription, enzymes, neurons, and heme synthesis [5,6]. Lead may also be harmful to the developing immune system, causing production of excessive inflammatory proteins which is a risk factor for asthma development in children [7]. Mercury is capable of inducing a wide range of clinical presentations such as fatigue, anxiety, depression, odd paresthesias, weight loss, memory loss, and difficulty in concentrating and these are the symptoms of low-grade chronic mercury exposure. Mercury also exist in various forms (mercurous and mercuric) and they have the ability to deposit in most parts of the human body [8,9]. Acute poisoning with mercuric salts (typically $HgCl_2$) generally targets the gastrointestinal tract and the kidneys. Extensive precipitation of enterocyte proteins occurs, with abdominal pain, vomiting, and bloody diarrhea with potential necrosis of the gut mucosa. This may produce death either from peritonitis or from septic or hypovolemic shock [8]. It was reported that chronic low level mercury exposure in workers from a mercury recycling plants was associated with visual disturbances but not neuropsychological changes [10]. Arsenic exposure comes with immediate symptoms like abdominal pains, vomiting and diarrhea. It also affects the skin severely leading to skin pigmentation, lesion, hand patches on the palms and soles of the feet and different types of cancer result on further exposure [11-13]. Cadmium can affect several organs when they are exposed to increased or accumulated quantities. Cadmium affects the kidney primarily because the kidney tubules receive much of the toxic effects although it has toxic effects on other parts of the kidney [14-16]. Cadmium can also induce bone damage as well as affect the placenta, liver, lungs and the reproductive system causing infertility [17-21]. Therefore, the study aimed at investigating the levels of some heavy metals: lead, mercury, cadmium and arsenic as well as the kidney and liver function tests in industrial workers who have been occupationally exposed.

Materials and methods

Participants

The design of the study was approved by the Ethical committee of the Faculty of Health Sciences and Technology, College of Health Sciences, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria and informed consent was received from all participants before the commencement of the work. A total of 131 participants comprising 81 industrial workers from three different companies and 30 control participants were investigated. The industrial workers were grouped into three groups (Groups 1, 2 and 3) according to their industries. Group 1 consist of 40 participants working in a leading automobile oil producing industry and they are involved in the production of engine oils used by cars of different types, big trucks, motorbikes, and generator of different sizes. The workers in group 2 (31 participants) were involved in producing vegetable oil and soap. Group 3 (30 participants) comprise those who were involved with the recycling of lead from lead products, lead damaged batteries, processing and crushing of battery plastic containers. The recycled lead is used to produce battery locally while some are exported abroad while the crushed plastic battery containers are transported and sold to plastic producing industries. The control participants (30) were apparently healthy subjects who have not been occupationally exposed to heavy metals. Six millimeters of blood specimen were collected from the participants into plain non-anticoagulant bottles after they gave their consents. The serum was separated into another clean container before analysis.

Determination of heavy metals

Serum levels of the metals (Hg, Pd, As and Cd) were determined with flame atomic absorption spectrophotometer (AAS) using a direct method [22]. The method is based on the principle that atoms of the element when aspirated into AAS vaporized and absorbed light of the same wavelength as that emitted by the element when in the excited state.

Estimation of Alkaline phosphatase (ALP)

ALP at an alkaline pH hydrolyses di-sodium phenylphosphate to form phenol. The phenol formed reacts with 4-aminoantipyrine in the presence of potassium ferricyanide as an oxidising agent, to form a red colour complex. The intensity of the colour formed is directly proportional to the activity of ALP present in the sample [23].

Estimation of Aspartate (AST) and Alanine (ALT) amini transferases

Amino group is enzymatically transferred by AST / ALT present in the sample from L-aspartate/ alanine to the carbon atom of 2-oxoglutarate yielding oxaloacetate / pyruvate and L-glutamate. AST/ ALT activity is measured by the concentration of oxaloacetate/ pyruvate hydrozone formed from the reaction with 2,4- dinitrophenyl hydrazine [24].

Determination of conjugated and total bilirubin

Bilirubin in the sample reacts with diazotized sulphanilic acid to form the purple colour azobilirubin (direct bilirubin). In the presence of methanol, the same reaction is used to measure total bilirubin. The intensity of the colour produced is directly proportional to bilirubin concentration [25].

Determination of serum urea

Urea reacts with diacetyl monoxime at high temperature in an acid medium at high temperature in the presence of cadmium ions and thiosemicarbazide. The absorbance of the red colour produced is measured in a spectrophotometer and it is directly proportional to the concentration of urea in the sample [26].

Determination of serum creatinine

Creatinine reacts with picric acid in alkaline medium. The absorbance of the yellow-red colour produced is measured spectrophotometrically [27].

Statistical analysis

The Mean and Standard Deviation (SD) were calculated for each parameter using Statistical Package for Social Sciences (SPSS version 17.0). Differences in the means for each parameter between the two groups were compared using analysis of variance (ANOVA).

Results

The mean serum levels of the heavy metals in the workers from the industries as well as Control participants are presented in Table 1. Mercury in groups 1 and 2 were significantly higher ($p<0.05$) compared to group 3 and control. Table 2 shows the

Table 1: The levels of Lead, Mercury, Cadmium and Arsenic in the Industrial workers and control participants

Parameters	Group 1 Mean ± SD N=40	Group 2 Mean ± SD N=31	Group3 Mean ± SD N=30	Control Mean ± SD N=30	F-value	P-value
Lead (µg/dl)	15.81 ± 6.00	17.53 ± 5.20	19.40 ± 4.40	4.20 ± 2.40	23.342	0.000*
Mercury(µg/dl)	0.73 ± 0.03	0.75 ± 0.03	0.24 ± 0.20	0.04 ± 0.01	20.430	0.000*
Cadmium (µg/dl)	0.10 ± 0.02	0.10 ± 0.04	0.20 ± 0.20	0.05 ± 0.05	6.255	0.001*
Arsenic (µg/dl)	0.06 ± 0.02	0.05 ± 0.01	0.14 ± 0.12	0.03 ± 0.01	17.807	0.000*

**= Significant at p<0.05*

Table 2: Kidney and Liver function tests in the industrial workers and control subjects

Parameters	Group 1 40	Group 2 31	Group 3 30	Control 30	F value	P value
Serum urea (mmol/L)	4.63 ±1.25	6.35±1.33	4.30 ±1.01	4.44±1.32	19.847	0.000*
Serum creatinine (µmol/L)	72.50±20.18	116.32±44.52	85.23±22.85	91.50±29.23	13.155	0.000*
Serum alkaline phosphatase (IU/L)	68.93±13.17	72.90 ± 14.10	71.35±13.72	70.20±16.26	0.495	0.687
Serum aspartate amino transferase (IU/L)	8.65 ±2.34	9.07 ±2.10	8.13±2.06	8.92 ±2.00	1.357	0.259
Serum alanine amino transferase (IU/L)	9.08±4.52	8.84±2.53	7.23 ± 2.62	7.01 ±2.10	3.992	0.009*
Serum conjugated bilirubin (µmol/L)	2.59 ± 0.14	3.53 ±4.09	2.63 ± 0.18	2.55±1.19	1.798	0.150
Serum total bilirubin (µmol/L)	11.60 ±0.57	11.71 ±0.68	11.33 ±0.65	10.02 ± 1.84	18.460	0.000*

**= Significant at p<0.05*

kidney and liver function tests in the industrial workers. There were significant differences in the levels of serum urea, creatinine, alanine amino transeferase and total bilirubin in the industrial workers compared with control.

Discussion

Heavy metals are potentially dangerous to health and prolonged exposure can cause damage to the organs of the body. Many industrial workers are not aware of the risk associated with this occupational exposure. Previous workers have shown increased levels of heavy metals in mechanical industries and vehicle construction industries which use metals like chromium, lead zinc, copper, manganese and nickel [28]. The finding of high levels of lead in the industrial workers could be attributed to the raw material (Pb) that is commonly used. One of the industries is involved in the recycling and production of pure lead and lead batteries. This industry recycles lead from used and damaged motor batteries. Some of this recycled Pb is also exported abroad while some are used locally for the production of motor batteries.

Consequently, these workers may get exposed to lead either through ingestion (hand–to-mouth or contaminated food), inhalation through the lungs or through the skin. The relative high values of lead observed in the industrial workers could also be attributed to toxic waste chemicals, drinking and bathing from the borehole water inside the industries [1]. This water is run through lead pipes to prevent rusting because this water is mainly used for the cooling of their machines and other purposes. This finding is in line with previous report [29] which showed increases in the level of lead in the subjects investigated. The high level of mercury observed in this study is in line with the findings of increased mercury in industrial workers [10]. This could have been encountered during the course of working with some electrical-equipments and in some chemicals [30]. Human toxicity has been shown to vary with the forms of mercury, the dose and the rate of exposure. The target organ for inhaled mercury vapor is primarily the brain. Mercurous and mercuric salts chiefly damage the gut lining and kidney while methyl mercury is widely distributed throughout the body [31].

Occupational exposure to cadmium and chromium has been reported in different workers such as electroplating, steel making, leather tanning, photography, dyeing and chemical manufacture operations [28]. The high level of cadmium found in the industrial workers can possibly be attributed to the introduction of cadmium in the environment through sewage sludge, fertilizer and ground water leading to the contamination of vegetables and food crops. This is because a larger number of the workers live around the industries and have farm lands where they cultivate crops. The consumption of the contaminated farm products may possibly lead to cadmium exposure [32]. Furthermore, the significant level of arsenic in the workers could possibly be due to effluent from industrial waste, petrochemicals and fuel which are common source of arsenic. These workers may get exposed to Arsenic during lead smelting because arsenic is a content of smelted lead [33].

The result from the study also show that out of the four tested heavy metals (Pb, Hg, Cd and As) in the various groups; lead has the greatest concentration in the industrial workers when compared with the reference values [3,4]. This is in line with the report which stated that among the heavy metals, those having the most serious health implications are arsenic, lead, cadmium, and mercury [34]. Lead has been recognized for centuries as a cumulative general metabolic poison [35]. It is a neurotoxin and it is responsible for neurological signs such as pains, muscle weakness, mental problems and symptoms associated with abdominal pains, nausea, vomiting diarrhea [7]. Although Mercury, Cadmium and Arsenic pose major health problems as earlier mentioned, the levels observed in this study were minimal in the individual workers as to cause serious health problems.

The serum urea and creatinine levels showed significant increases in Group 2 when the levels in the industrial workers were compared with the control. The result is in line with a previous report which showed that exposure to heavy metals can cause vascular or renal damage [36]. Long term exposure to heavy metals have been linked to various complications such as renal dysfunction, joints and reproductive systems, cardiovascular system and acute and chronic damage to the central nervous system (CNS) and peripheral nervous system (PNS) [37,38]. Among the liver function tests, alanine amino transeferase showed significant increase in Groups 1 and 2 when the industrial workers were compared with the control. Total bilirubin also showed significant increase in the industrial workers compared with the control. This implies that there may be liver involvement especially during a long term exposure and at higher concentration [39,40].

Conclusion

The result of this study showed that the heavy metals were significantly increased in the industrial workers

compared with the control. Chronic exposure to these heavy metals may predispose the industrial workers to serious adverse health effects.

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Enhancing mothers' home management and prevention of malaria through community health nursing interventions

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Abstract

Background: Malaria contributes significantly to under-five mortality in Nigeria. Home management and prevention of malaria are key interventions for its control. However, effectiveness of these interventions require mothers' adequate knowledge and appropriate skills. The 2011 Disease surveillance and notification report of Osun state showed that the under-five malaria burden in Egbedore Local Government Area (LGA) was more than one third of the total in the state for all age groups in 2008, 2009 and 2010. This study assessed effects of nurse-led health education and supportive supervision on knowledge and practice of home management and prevention of malaria by mothers of under-fives in the LGA.

*Materials and method***:** The study utilised quasi-experimental design. Stratified sampling technique was used to select 837 mothers of under-fives in seven out of ten wards of the LGA.The mothers were randomly assigned into one Control Group (CG) and two intervention groups: Health Education Group (HEG) and Health Education and Supportive Supervision Group (HESSG). The study instruments were observation checklist and structured questionnaire. Data collection was at pre- (P1) and post-interventions at one month (P2), three months (P3) and six months (P4). Data were analysed using descriptive statistics, Chi square test and ANOVA at p = 0.05.

Results: There were significant improvements in overall knowledge scores of the intervention groups at post-intervention. These improvements appreciably translated to better practice of home management and prevention of malaria and this relationship was significant.The home environment, headship of family and family structure significantly influenced home management and prevention of malaria.

Conclusion: Nurse-led health education and supportive supervision improved knowledge and practice of home management and prevention of malaria in Egbedore LGA. These approaches are therefore recommended.

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Keywords: *Nurse-led health education, Nurse-led supportive supervision, Under-fives, Home management of malaria, Malaria prevention.*

Résumé

Contexte: Le paludisme contribue significativement à la mortalité des moins de cinq ans au Nigeria. La gestion et prévention à domicile du paludisme sont des interventions clés pour son contrôle. Cependant, l'efficacité de ces interventions nécessite des connaissances adéquates et des compétences appropriées des mères. Le rapport de surveillance et de notification des maladies, 2011, de l'état de Osun a montré que le fardeau du paludisme des moins de cinq ans dans la communauté d'Egbedore était plus d'un tiers du total de l'état pour tous les groupes d'âge en 2008, 2009 et 2010. Cette étude A évalué les effets de l'éducation sur la santé dirigée par les infirmières et la supervision de soutien sur la connaissance et la pratique de la gestion et prévention à domicile du paludisme par les mères des moins de cinq ans dans la communauté.

Matériaux et méthode: L'étude a utilisé un modèle quasi-expérimental. La technique d'échantillonnage stratifié a été utilisée pour sélectionner 837 mères de moins de cinq ans dans sept quartiers sur dix de la commune. Les mères ont été réparties au hasard dans un Groupe témoin (CG) et deux groupes d'intervention: Groupe d'Education Sanitaire (GES) et Groupe d'Education Sanitaire et de Supervision de Soutien (GESSS). Les instruments d'étude étaient une liste de contrôle d'observation et un questionnaire structuré. La collecte des données a été effectuée au pré (P1) et après les interventions à un mois (P2), trois mois (P3) et six mois (P4). Les données ont été analysées à l'aide de statistiques descriptives, du test du Chi-carré et de l'ANOVA à p = 0,05.

Résultats: Il y a eu des améliorations significatives dans les notes globales de connaissances des groupes d'intervention lors de la post-intervention. Ces améliorations se sont traduites sensiblement par une meilleure pratique de la gestion à domicile et de la prévention du paludisme et cette relation était significative. L'environnement familial, le leadership

familial et la structure familiale ont considérablement influencé la gestion et prévention à domicile du paludisme.
Conclusion: L'éducation à la santé et la supervision de la santé menées par les infirmières ont permis d'améliorer la connaissance et la pratique de la gestion et prévention à domicile du paludisme dans la communauté d'Egbedore. Ces approches sont donc recommandées.

Mots-clés: *Éducation à la santé dirigée par les infirmières, supervision de soutien menée par les infirmières, Moins de cinq ans, Gestion à domicile du paludisme, Prévention du paludisme*.

Introduction

In malaria endemic zone of the world like Nigeria, fever is considered a symptom of malaria until proven otherwise. The fever is usually first treated at home by mothers and care givers, but this kind of treatment may not be effective because the caregivers lack appropriate knowledge of malaria treatment [1, 2]. Ineffective intervention usually results in deterioration of initial uncomplicated to complicated malaria, characterised by high fatality rates among under-five children [1-3]. For instance, the 2011 Disease surveillance and notification report of Osun state showed that the under-five malaria burden in Egbedore Local Government Area (LGA) of Osun state Nigeria was more than one third of the total in the state for all age groups in 2008, 2009 and 2010 [4].

Utilisation of preventive measures is also at low level in Nigeria. A survey on utilisation of insecticide–treated nets by under-five children in Nigeria revealed that household ownership of any net was 23.9% and 10.1% for ITNs while utilisation rate of any net by children under-five was 11.5% and 1.7% for ITNs [5]. This falls far below the Abuja target, which is based on the protection of 60.0% of all pregnant women and children by 2005. In fact, the nets were not available in large quantities in the study area. As at December 2011 Egbedore LGA received only 2450 [6], this figure is rather too low for a whole local government area with population of 73,969.

The inappropriate home treatment and prevention of malaria is currently a major concern in the treatment of the disease, hence the need to imbibe the concept of community-based initiatives in ameliorating the greatest challenge of malaria treatment by health educating or training caregivers (blood and surrogate mothers) in recognising malaria illness and instituting prompt and appropriate home management[7]. Health workers are loaded with this responsibility, however, due to lack of human and material resources, health educating or training of mothers have been mere passing information to mothers without follow up or supervision. Often, health education or training alone may not be enough to enhance sustenance of community health consumers' knowledge and practice of prevention and management of diseases, nurses need to support them through supervision to ensure quality outcome [8]. Home visit is a form of supervision which is commonly utilised in implementation of primary health care (PHC) services [9]. However, the service is facing many challenges in Nigeria, one of such challenges as identified by Alenoghena *et al* is inadequate funding [9].

In view of this, there is need for a paradigm shift that will provide a forum for supportive supervision within the health centres where the health care providers and health care consumers can be opportune to meet regularly and jointly identify and solve problems and challenges related to treatment and prevention of diseases, so that only patients with very serious problem will be followed up to their homes with the few available resources. Supportive supervision is defined as "range of measures to ensure that personnel carry out their activities effectively through direct personal contact on a regular basis to guide, support and assist designated staff to become more competent in their work."[10] This type of supervision was adapted to guide, support and assist the health care consumers to develop self-efficiency in their self care with a view to promoting good health and preventing diseases, thus utilisation of two interventions (health education and supportive supervision) in this study to enhance and sustain mothers' home management and prevention of malaria in Egbedore LGA in Osun state Nigeria

Materials and method

Study site and population

This study was conducted in Egbedore local government area, Osun state Nigeria. The local government area is located at the North West of the state [11] with population of 73,969, consisting of 37,302 males and 36,667 females [12].The inhabitants of Egbedore LGA are predominantly Yorubas of the Oyo extraction. There were 22 primary health care facilities owned by the LGA and one National Primary Health Care Centre in the LGA as at the period of this study [11]. The target population for this study were mothers of under-five children residing in Egbedore LGA in Osun State South West of Nigeria.

The research design

The research design was quasi-experimental and it was conducted in three phases. There were two experimental groups: Health education and supportive supervision group (HESSG) and Health education group (HEG) and one control group. The first phase of the study included activities on community entry and collection of baseline data on the respondents' knowledge of malaria relating to causes, transmission, symptoms, its treatment and prevention including practices of home management and prevention of malaria.

At the second phase, the mothers in health education and supportive supervision group (HESSG) were exposed to health education programme and supportive supervision while health education group (HEG) were exposed to health education programme only. The manual for the programme consisted of five modules as thus: 1- causes, transmission and importance of malaria, symptoms of uncomplicated and complicated malaria, 2 - Medical treatment and home management of malaria, 3- preventive measures of malaria and health promotion, 4- environmental management for control of malaria and 5- misuse of drugs. Thereafter, the HESSG had six-month supportive supervision in form of monthly personal interaction meetings by there searchers and two other public health nurses who were research assistants. They collaborated with the mothers to jointly identify and solve problems and challenges that the mothers might be experiencing in the process of preventing and treating malaria among their under-five children.

The third phase was evaluation of the mothers' knowledge and practices of home management and prevention of malaria among their under-five children at one month, three months and six months post-intervention. The study was carried out over a period of one year in order to enable the participants to exhibit appreciable behavioural change.

Sampling procedure and sample size

The sample size for the study was calculated using the formula* below;

$$n = \frac{1}{1-f} \times \frac{2 \times (Z_\alpha + Z_\beta)^2 \times P \times (1-P)}{(P_1 - P_2)^2}$$

Where Zα = standard normal deviation corresponding to 2-sided level of significance of 5% = 1.96

Zβ = standard normal deviation corresponding to a power of 85% = 1.03

P_1 = baseline proportion of under-five children who slept under any net pre-intervention estimated using proportion of under-five children who slept under mosquito net the night before in the National Demographic Health Survey (NDHS) 2008which was 11.9 % (NPC and ICF International 2009). (Any net data was used to cover all preventive measures because not all other measures were documented in previous studies or surveys except insecticide treated nets (ITNs) which was 5.5% in this same survey)[13].

* **Source of the formula:** Kasiulevičius, V., Šapoka, V., and Filipavičiūtė, R. (2006) Sample size calculation in epidemiological studies *Gerontologija* 2006; 7(4): 225–231

Outcome of the sample size calculation with this epidemiological formula was 279 respondents per research group. Hence, a total of 837 mothers of under-five children who fulfilled the inclusion criteria (i.e. having at least an under-five child and residency in the selected communities for the study for a minimum of one year) were selected for the three research groups (i.e. control, Health education group and health education and supportive supervision group).

Stratified random sampling procedure was used for selection of the mothers in seven wards of the LGA. At the first stage, Egbedore LGA was stratified into four geographical areas; (A), (B), (C) and (D), using major roads that pass through the LGA; A-West, B - North-East, C – West and D - South

At the second stage, simple randomization was used to pick and designate three of the strata into intervention and control groups. The third stage of the sampling procedure entailed selection of women in the communities. Based on the proportional sample calculated from the projected population figures of women of reproductive age, the ratios for selecting respondents in each community were; - Ido-Osun 1 to 5 and Egbedi - 1 to 3 (HESSG);Ara, Ojo and Aro -1 to 3 (HEG); Iragberi, Ikotun and Olope - 1 to 3 (CG).Balloting was used to pick a mother of under-five children in a household where they were more than one. Where there was no mother with under-five child in a house, the next house was visited and subsequent third and fifth house was calculated from the last one with an under-five child.

Ethical Consideration

Approval was obtained from Ladoke Akintola University of Technology (LAUTECH) Teaching Hospital Osogbo, Osun state ethical committee.

Permission was also obtained from the chairman of Egbedore local government area and the head of the household. Written informed consent was obtained from the study participants.

Data collection procedure

Two instruments were used for data collection; questionnaire and checklist. The questionnaire was developed in English language, translated into local language (Yoruba) and back translated and pretested before use. The questionnaire was also subjected to congruence and test retest reliability tests, the coefficient of stability (r) was 0.937 and *p*- 0.000 and the comparison of the Yoruba and English tests measured the coefficient of equivalence (r) as 0.914 with its *p* -0.000. The reliability test in comparison of the two Yoruba versions gave (r) as 0.971 and *p* - 0.000. It consisted of 46 questions grouped into nine sections; section A: name of nearest health facility in the community; section B: demographic characteristics of the mother and the household; section C: knowledge of causes, transmission and symptoms of malaria; section D: knowledge of home management of malaria; section E: knowledge of malaria preventive measures; section F: knowledge of complications of malaria; section G:practices of home management of malaria; section H:practices of malaria preventive measures section I: outcome of malaria management experiences

The checklist was used to assess the structure of home environment of the respondents to determine their suitability for prevention of malaria. It consisted of 11 questions and statements that were filled by research assistants on reaching the respondents' households. The respondents' scores for levels of knowledge and practices were converted to per cent, mean scores and standard deviation were also calculated for further analysis.

Results

The target number of 837 mothers of under-five children at 279 per group participated at first phase. Two hundred and eighty one (281) mothers in intervention group one (HESSG) and 269 mothers in intervention group two (HEG) attended the health education programme. Two hundred and fifty-nine (259) respondents in HESSG, 256 in HEG and 236 in the control group completed the study.

Table 1 shows the demographic characteristics of the respondents. The mean age of the mothers in the HESSG was 31.2 and the standard deviation was 7.0. In HEG, the mothers' mean age was 32.2 with standard deviation of 10. The mothers' mean age in the control group was 32.4 and the standard deviation was 9.6. The mean size of the family of majority of the households in all the research groups ranged from 5.2 to 5.7 and the standard deviation was between 2.0 and 2.6. Most mothers (between 59.5 per cent and 68.1 per cent) in all the research groups had one under-five child.

Calculation of knowledge and practice scores

All the multiple responses were given "yes" and "no" options and the correct options were allocated one (1) each while the wrong ones was zero (0). The minimum mark obtainable for all types of knowledge and practice is zero (0) while the maximum marks obtainable (MMO) for each type of knowledge and practice assessed are:

Knowledge of causes, transmission and symptoms (knowledge one) – MMO = 39

Knowledge of home management (knowledge two) –MMO = 36

Knowledge of preventive measures (knowledge three) – MMO = 11

Total knowledge scores = 86

Practice of home management (practice one) – MMO = 38

Practice of preventive measures (practice two) – MMO = 20

Total practice scores = 58

The respondents' scores were converted to per cent, mean scores and standard deviation were also calculated for further analysis.

Knowledge of causes, transmission and symptoms of malaria, home management and prevention of malaria

At the three phases of post-intervention, there were improvements in the levels of knowledge of causes, transmission and symptoms of malaria, home management and prevention of malaria among the two intervention groups. The mean of total knowledge scores for HESSG significantly (*p*= 0.000) increased from 40.15±6.45 at pre-intervention to 73.32±5.15, 73.65±5.84 and 74.13±5.81 at post-intervention one, post-intervention two and post-intervention three respectively. For HEG, the mean of total knowledge score significantly (*p*= 0.000) increased from 37.90±5.03 at pre-intervention to 66.90±6.30, 74.65±4.78 and 71.04±6.75 at post-intervention one, post-intervention two and post-intervention three respectively. There was no significant difference in total knowledge's mean score within CG at post-intervention phases (p= 0.895 p= 0.951, p= 0.848). Details are found in Table 2.

Table 1: Demographic characteristics of the families of the respondents

Variable	HESSG (n = 279)	HEG (n = 279)	Control (n = 279)
Age (years)			
15 - 24	38 (13.6%)	46 (16.5%)	40 14.3%)
25 – 34	153 (54.9%)	128 (45.5%)	140 (50.2%)
35 – 44	78 (27.9%)	78 (27.9%)	68 (24.4%)
45 – 54	7 (2.5%)	12 (4.3%)	20 (7.2%)
55 and above	3 (1.1%)	15 (5.7)	11 (3.9%)
Mean	31.2	32.2	32.4
Standard deviation	7.0	10	9.6
Educational status			
No formal schooling	18 (6.5%)	52 (18.6%)	75 (26.9%)
Primary school	64 (22.8%)	101 (36.2%)	87 (31.2%)
Junior secondary sch. 1-3	25 (9.0%)	48 (17.2%)	28 (10.0%)
Senior secondary sch. 1-3 /Technical sch./ Grade 2	127 (45.5%)	64 (22.9%)	76 (27.2%)
Post-secondary school	45 (16.2%)	14 (5.0%)	13 (13%)
Marital status			
Married	264 (94.6%)	258 (92.5%)	254 (91.0%)
Single parent	15 (5.4%)	21 (7.5%)	25 (9.0%)
Headship of the Household			
Respondent	24 (8.6%)	35 (12.5%)	29 (10.4%)
Husband	255 (91.4%)	244 (87.5%)	250 (89.6%)
Family structure			
Nuclear	226 (81.0%)	187 (67.0%)	204 (73.1%)
Extended	53 (19.0%)	92 (33.0%)	75 (26.9%)
Household characteristic			
Monogamous	224 (80.3%)	192 (68.8%)	180 (64.5%)
Polygamous	40 (14.3%)	66 (23.7%)	74 (26.5%)
Single parent	15 (5.4%)	21 (7.5%)	25 (9.0%)
Household size			
3-6	216 (77.4%)	217 (77.7%)	194 (69.5%)
7 and above	63 (22.6%)	62 (22.3%)	85 (30.6%)
Mean	5.2	5.5	5.7
Standard deviation	2.0	2.3	2.6
No of under-five children per mother			
One	166 (59.5%)	178 (63.8%)	190 (68.1%)
Two	101 (36.2%)	84 (30.1%)	75 (26.9%)
Three	12 (4.3%)	17 (6.1%)	14 (5.0%)

Practice of home management and prevention of malaria

Home management of malaria by the respondents included what they did to reduce fever and treat malaria whenever their children had malaria fever, eight different actions (i.e. Expose the child and fan him/her; bath the child with lukewarm or tepid water; give the child enough fluid; give the child medicines to treat malaria; give herbal preparations (agbo); take the child to health facility immediately; take the child to pharmacy/patent medicine store and take the child to traditional healer) were listed from which they were expected to choose. The respondents were also expected to mention the medicine used for treatment of malaria and describe administration of such medicines.

Practice of prevention of malaria were actions respondents usually take to protect their children from mosquito bites. They were expected to indicate which of the 10 listed preventive methods (i. e. Use of window and door nets; protecting oneself by wearing long sleeved clothes and full trousers; applying insect repellant creams; spraying the house with insecticide aerosol; using Long Lasting

Table 2: Mean and standard deviation of total knowledge and practice scores of the respondents

Variables	Intervention One (HESSG)'		Intervention Two (HEG)		Control	
P1	Pre-intervention					
	Mean	STD. Deviation	Mean	STD. Deviation	Mean	STD. Deviation
Total Knowledge	40.15	6.45	37.90	5.03	38.27	4.38
Total Practice	20.94	6.60	18.10	4.73	18.58	4.18
P 2	Post-intervention at one month					
Total Knowledge	73.32	5.15	66.90	6.30	45.82	7.65
Total Practice	39.80	5.56	36.98	4.11	25.15	5.57
P 3	Post-intervention at three months					
Total Knowledge	73.65	5.84	74.65	4.78	45.87	7.66
Total Practice	40.53	6.40	40.72	6.08	25.21	5.60
P 4	Post-intervention at six months					
Total Knowledge	74.13	5.81	71.04	6.75	45.85	7.55
Total Practice	40.84	5.05	38.91	5.61	25.12	5.60

Insecticidal Nets (LLINs) / Insecticide Treated Nets (ITNs) every day; destroying the breeding sites of mosquitoes around the house; throwing away containers, broken pots, unused tyres where water collect and mosquitoes breed; cutting grasses around the house and community; covering containers used to store water as well as filling up potholes and pools of water that do not flow) they used for their children and indicate how often they used it/them.

The study revealed that the majority of the respondents in HESSG and HEG fell in the category of good practices of home management and prevention of malaria throughout the post-intervention periods. At pre-intervention, the mean of total practice score of HESSG was 20.94±6.60, it increased to 39.80±5.56 at post-intervention one, 40.53±6.40 at post-intervention two, and 40.84±5.05 at post-intervention three. The HEG had 18.10±4.73 at pre-intervention, which increased to 36.98±4.11 at post-intervention one, 40.72±6.08 at post-intervention two and 38.91±5.61 at post-intervention three. The difference in total practice scores of control group was not significant at post-intervention phases (post-intervention one = 25.15±5.57, post-intervention two = 25.21±5.60 and post-intervention three = 25.12±5.60). Table 2 presents details of the results.

Factors associated with practice of home management and prevention of malaria

One of the objectives of the study was to identify factors that were associated with home management and prevention of malaria among mothers of under-five children. Multinomial logit model was used to determine the relationship between the demographic data of the respondents and their practice of correct home management and prevention of malaria. The categories of scores for practice of home management and prevention of malaria were entered into multinomial logit equation as the dependent variables while the demographic data were entered as the independent variables. Cross tabulation analysis was also carried out to determine the association between the environmental variables on the checklist and their practices of correct home management and prevention of malaria. The categories of scores for practice of home management of malaria and prevention of malaria were entered into columns of the cross tabulation as the dependent variables. While the environmental variables were entered into the rows as independent variables.

The results revealed that practice of correct home management of malaria was significantly but negatively influenced by the head of household

Table 3: Independent sample t-test of difference between the Health Education and Supportive Supervision Group (HESSG) and Health Education Group (HEG) in the practice of home management and prevention of malaria

Phases of the study	Variable	Mean difference	Mean deviation	Standard	t-value	p-value
Home management of malaria						
Post-intervention one	Practice of home management of malaria	HESSG - 16.7 HEG-13.1	3.58	HESSG-5.9 HEG- 4.0	8.1	.000*
Post-intervention two	Practice of home management of malaria	HESSG - 15.1 HEG -15.2	- 1.90	HESSG - 5.1 HEG- 2.7	- 0.307	.759
Post-intervention three	Practice of home management of malaria	HESSG - 16.2 HEG-16.3	-1.90	HESSG-4.6 HEG- 2.7	0.176	.861
Prevention of malaria						
Post-intervention one	Practice of prevention of malaria	HESSG-14.2 HEG-10.7	2.5	HESSG-2.9 HEG- 3.0	13.6	.000*
Post-intervention two	Practice of prevention of malaria	HESSG-13.0 HEG -12.7	0.3	HESSG-2.8 HEG- 3.2	1.0	.305
Post-intervention three	Practice of prevention of malaria	HESSG – 13.5 HEG-12.8	0.7	HESSG-2.4 HEG- 2.7	3.2	.001*

*The mean difference was significant at the 0.05 level.

(t= -2.779; p = 0.005) and family structure (t = - 6.184; p = 0.000). This implies that practice of correct home management of malaria was poor in households headed by the respondents and extended families. Similarly, the findings of the study showed that family structure significantly influenced the respondents' practice of prevention in negative direction at both first level (movement from poor practice to fair practice (t = - 4.583; p = 0.000) and second level (movement from fair practice to good practice (t = - 3.975; p = 0.001) of probability. Implication of the finding is that extended families practiced prevention of malaria poorly while the practice was good in nuclear families. The respondents' educational status (t = 0.389; p = 0.000) significantly influenced their practice of prevention positively at second level of probability i. e. those who possessed higher qualification practiced prevention of malaria better than those with lower qualification.

In consideration of the environmental variables, the findings of the study revealed that majority (88.1%) of the respondents who lived in face-to-face houses had good practice of home management of malaria. The respondents' (74.3%) whose houses were plastered, those (92.3%) whose floors of houses were plastered, 81.7% of those whose ceilings of the houses were covered with asbestos and 93.1% of those whose surroundings were not bushy had good practice of home management of malaria. The results also revealed that the practice of prevention of malaria among all respondents was associated with type of house as majority (87.7%) of the respondents living in face-to-face houses had good practice of prevention of malaria. Similarly, the highest number of respondents whose walls of the houses were plastered (73.8%), floors of the houses were plastered (91.9%) and ceiling covered with asbestos (84.8%) had good practice of

prevention of malaria. All these are evidences of economic status of the respondents

Comparison of the effects of health education with that of health education and supportive supervision on home management and prevention of malaria among mothers of under-five children post-intervention

The findings of this study as presented in Table 3 revealed significant difference (t = 8.1; p = .000) between the HESSG and HEG in home management of malaria at post-intervention one but difference was not significant at post-interventions two and three phases respectively (t = -0.307; p =759) (t = -0.176; p = .861). Independent t-tests revealed significant differences in practice of prevention of malaria between the HESSG and HEG at post-interventions one (t = 13.6; p = .000) and three (t = 3.2; p = .001) but the difference was not significant at post-intervention two. This implies that the significant difference in home management of malaria was strongly noted during the first month of the supportive supervision, while the significant difference in prevention was strongly noted during first and sixth month of the supportive supervision when the mothers were given free long lasting insecticidal nets freely by the state government.

Discussion

At baseline of this study, the majority of the respondents had low level of knowledge of causes, transmission and symptoms of malaria as well as home management of malaria and poor knowledge of prevention of malaria. Sequel to intervention, there were improvements in the level of knowledge among the two intervention groups as they all had good knowledge of causes, transmission and symptoms of malaria, home management and prevention of malaria. This is consistent with similar studies [14-17] where respondents' level of knowledge of malaria significantly increased post-educational intervention. The higher levels of knowledge of the intervention groups over that of the control groups shows that mothers of under-five children were well disposed to health education to assist them in improving their level of knowledge on home management and prevention of malaria. This finding agrees with what obtained in many previous similar studies [16, 18].

The improvements in knowledge post-intervention appreciably translated to better practice of home management of malaria and this relationship was significant. The findings reflected significant relationship between levels of knowledge of causes, symptoms and transmission of malaria and correct home management of malaria among the respondents' post-intervention. This could be explained by the fact that correct knowledge of the causes, symptoms and transmission of malaria has been reported to influence one's ability to institute appropriate action in treating malaria at the onset of the signs and symptoms [15, 19] The findings are also consistent with previous studies in sub-Sahara Africa [15-18,20] where health education and training had positive impact on mothers and other caregivers' home management of malaria.

The improved preventive practice of majority of respondents at post-intervention was likely to have been boosted by distribution of two long lasting insecticidal net (LLINs) per woman in the State at the sixth month of the intervention by the government of the State of Osun and the Federal Ministry of Health. This finding is consistent with similar studies [16, 21] where it was found that the strongest predictors of insecticide treated nets (ITNs) use were age less than five years and increasing number of ITNs in a household.

The increase in knowledge scores of the control group at post-intervention at one month could be the effect of different media jingles on malaria prevention and control that all the communities had experienced as well as the influence of improved communication technology (use of cell phones) on the respondents. This was a very prominent limitation beyond the researcher's control. However, the control group could not maintain the increase at post-intervention at three and six months because there was no significant increase in the knowledge and practice scores of the group. Similar finding was reported in Bhutan [16] where the number of respondents in control group who knew that their houses should not be plastered or whitewashed for at least six months after indoor residual spraying to retain chemical effectiveness increased from 1.5% at pre-intervention to 9.8% at post-intervention.

The finding of this study at post-intervention at one month revealed significant difference in the practices of home management of malaria between the health education and supportive supervision group (HESSG) and the health education only (HEG). This agrees with the finding of a study in Uganda [22] where there was an improvement in malaria diagnosis and fever case management, using rapid diagnostic test (RDTs) at primary health care (PHC) facilities, following supportive supervision they rendered to the study subjects. However, at post-intervention phases two and three, the differences in levels of practices found in the HESSG and HEG was not significant. This finding could be explained by the fact that the attendance of the participants at

the monthly supportive supervision meetings was not good enough, not up to 50.0% of the mothers who participated in the health education awareness programme attended the supportive meetings throughout the period of the supervision. This fair attendance by the mothers might be because the intervention is new and most mothers have not seen it as a forum for group therapy where their health challenges and problems could be resolved. The finding has significant implications for community health nurses as primary health care providers who should be making use of this model to sustain health promotion practices. Community health nurses need to be adequately trained on utilisation of supportive supervision among community health consumers now that there are dwindling human resources and logistic support for traditional home visit for sustainability of the health education strategy.

Majority of the respondents in the three research groups were married while few were either widows or single parents. Even though, marital status did not have direct significant association with good practice of home management and prevention of malaria, the findings revealed that female-headed households practiced home management and prevention of malaria poorly. The nuclear families were found to have practiced home management and prevention of malaria better than their counterparts from extended families. Probably their moderate family sizes made them to enjoy better socio-economic status that translated to better health status as it was stated in NDHS 2013 report that household composition usually determine the family's health status and well-being [23] Similarly, this finding might be explained by the fact that the role of head of household is the responsibility of men who are expected to provide financial support for the entire household members. Where women are playing this role, not all the responsibilities attached to the role will be fully achieved. Anyanwu commented that female-headed households have been observed in many recent studies to be poorer than male-headed households [24]. This might have been the reason for the poor practice of home management of malaria among the female-headed households in this study because they did not have opportunity of enjoying double income earnings. Obrist, Mayumana and Kessy quoting Hausmann *et al.* mentioned that female heads of households in Ifakara were at the risk of delaying treatment for their children due to inadequate resources [25].

Mothers' level of education was found to have influenced the practice of prevention of malaria, mothers with post-secondary school education had good practice of prevention of malaria. People with higher level of education have tendency to build on the existing knowledge and be able to read and understand any reading materials on their phenomenon of interest. Copies of the health education manual and handbills on malaria control were distributed to the mothers at the end of the programme; this must have enhanced their understanding and practice. This finding is consistent with the finding of a study in Kenya[26]where there was significant low ITN ownership in households with non-educated parents or guardians and significant higher percentage of ITN ownership in households where at least a member had primary or secondary education. The low level of education must have had effect on the respondents' economic status as education has been documented to increase the stock of human capital with subsequent increase in labour productivity and wages [24]. The poor socio-economic related factors that were associated with poor practice of home management and prevention of malaria as well as financial constraint that was generally recorded during supportive supervision meetings could be associated with this low level of education.

The extended families in this study had poor practice of home management of malaria. The implication of this finding is that the more expanded the family, the lesser the ability of the mother in managing malaria at home correctly. The reason for this might also be attributed to inadequate resources for provision of adequate care that is usually found in expanded families. This finding corroborates a study in Kenya [27] where there was association between large household sizes and increased probability of being poor, which the author stated might be because of large demands by larger households. However, the finding was in contrast to the finding in Egypt [28] where it was found that women living with extended families were likely to utilise antenatal clinics more than women in nuclear family.

The respondents who had good practice of correct home management of malaria were those who were living in flat and face-to-face houses, whose houses were plastered, whose house floors were plastered and were roofed with asbestos and environments were not bushy. All these environmental factors are evidences of better socio-economic status that usually enhances good standard of living and compliance with health promotion actions.

Conclusion

This study has demonstrated that improved malaria education is beneficial to the recipients; the health

education with supportive supervision significantly improved mothers of under-fives' knowledge and practice of home management and prevention of malaria in Egbedore LGA. Therefore, nurses should utilise these interventions to enhance and sustain mothers' malaria home management skills.

This study has been able to corroborate the existing fact that most of the barriers militating against effective treatment and prevention stem from poverty and lack of education. Therefore, it is imperative on the government to intensify efforts in improving economic empowerment, particularly among women, thus eradicating poverty.

Recommendations

In view of the findings of this study, community health workers should ensure transmission of appropriate information on health promotion practices through adoption of multidisciplinary approach in planning, implementing and evaluating health promotion programmes for the communities. Utilization of supportive supervision among health care consumers for sustainability of health education programme should be embraced by the community health workers. Further research studies should also be done on these interventions.

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Ethical dilemmas in assisted reproduction; Perspectives from a developing country

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Abstract
Background: Ethical dilemmas continue to unfold as a result of the expanding roles of assisted reproduction. Understanding the basic ethical principles of Autonomy, Justice, Beneficence and Non-maleficence as key components of practice when providing advanced fertility management cannot be over emphasized.
Ethics simply refers to the moral principles that govern a person or groups behavior. It is also defined as a code of moral principles derived from a system of values and beliefs that help define the correctness of our actions.
Critical opinions have been expressed in the area of commodification of human tissue. There are also growing concerns about cross border reproductive care and its implication on reproductive health.Since ethical dilemmas may not be resolved at once, continuous appraisal of the current situation with the aim of developing locally relevant ethical frames works is desirable.
Examining these ethical concerns which confront our daily practices is not only pertinent but expedient as there has been a gradual expansion of assisted conception services in Nigeria.

Keywords- *Ethics, dilemma, assisted reproduction*

Résumé
Contexte: Les dilemmes éthiques continuent de se dérouler en raison des rôles croissants de la reproduction assistée. La compréhension des principes éthiques de base de l'autonomie, de la justice, de la bénéfique et de la non- maléfice en tant que composantes clés de la pratique lors de la gestion avancée de la fertilité ne peut pas être sur appuyée.
L'éthique se réfère simplement aux principes moraux qui régissent un comportement de personne ou de groupe. Il est également défini comme un code de principes moraux dérivé d'un système de valeurs et de croyances qui aident à définir l'exactitude de nos actions.
Des opinions critiques ont été exprimées dans le domaine de la marchandisation des tissus humains. Il existe également des inquiétudes croissantes concernant les soins de reproduction transfrontaliers et ses implications sur la santé reproductive. Comme les dilemmes éthiques peuvent ne pas être résolus à la fois, une évaluation continue de la situation actuelle dans le but de contribuer au développement de l'encadrement éthique approprié sur le plan local est souhaitable.
L'examen de ces préoccupations éthiques qui font face à nos pratiques quotidiennes n'est pas seulement pertinent mais opportun; car il y a eu une expansion progressive des services de conception assistée au Nigéria.

Mots-clés: *Ethique, dilemme, aide à la reproduction*

Overview

Several ethical dilemmas have arisen from the practice of assisted reproduction and over the years have led to questioning the rationale to provide or refuse treatment, conduct research or participate in such. Critical concerns have been expressed in the areas of gamete sale and purchase which often connote commodification of human parts. The fact that the human embryo could be observed outside the body, generated intense curiosity as was observed with the conception and birth of Louis Brown in July, 1978.

"Ethics" is derived from the Greek word "Ethos" and refers to the moral principles that govern a person or groups behavior. It is also defined as a code of moral principles derived from a system of values and beliefs that help define the correctness of our actions. It is about right or wrong and the reasons we give for our choices and actions.

The key principles involved in ethics are Respect for persons (autonomy), Beneficence, Non-maleficence and Justice. Respect for person ensures confidentiality of treatment while Beneficence seeks to maximize good. Non-maleficence is an ethical duty to do no harm. Justice on the other hand refers to fairness and equitable distribution of benefits and risks.

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Regulatory frame work for assisted conception is currently in its infancy in Nigeria and the practice of assisted conception has been more facilitative than regulatory since a high premium is placed on childbearing. Virtually all forms of assisted reproduction are available in Nigeria[1] namely artificial insemination by husband (AIH,) donor insemination (DI), In-vitro fertilization (IVF),intra-cytoplasmic Sperm Injection (ICSI), embryo freezing and donation, Surrogate motherhood amongst others.

Examining the ethical dilemmas in the practice of assisted reproduction in a developing country like Nigeria may be a window of opportunity to explore factors affecting the uptake of assisted conception and possibly proffer home grown approaches to provide innovative services that are ethically and morally acceptable. Considerations like these culminated in the presentation of this paper at the monthly Oyo state continuous medical education programme on the 29th of March, 2016.

Gamete donation

In Africa, infertility is estimated to be as high as 45% of the population [2,3] and indeed an infertility belt has been described in Africa. About 10% of the population in all countries are infertile and women often delay marriage and childbirth in pursuit of education and careers [4]. This invariably contributes to the rising incidence of female infertility. The situation is similar in Nigeria, now that emphasis has been placed on education of the girl child. Advanced female age results in decreased fecundity thereby lowering probability of conception per cycle.

Controversies have trailed the use of donor gametes especially donor oocytes. Critical concerns relate to the sale and purchase of oocytes [4]. Current practices vary according to the countries involved. Countries in the European Union ban transactions relating to oocyte donation and only support altruistic donation [5]. Compensation is however paid for transportation, inconvenience and time [5]. The United States on the other hand, permits compensation for oocyte donors; however, this remains largely unregulated and may pose ethical concerns [6,7].

Gamete donation in Nigeria is driven essentially by commerce and it's comparable to the situation in the United States. Gamete donors whether sperm or oocyte, receive compensation for participating in the reproductive process. Altruistic donors may however be found amongst family donors. The need for compensation in low income countries cannot be overemphasized, however, it must be guarded from exploitation. Providing a regulatory framework and ensuring strict compliance by fertility clinic and recruiting agencies would ensure justice and equity for all parties involved. Fertility clinics in the United States are largely self-regulated using guidelines published by the American Society for Reproductive Medicine (ASRM) in addressing issues relating to communication, recruitment and benefits to oocyte donors [8]. It suggested the prudent use of oocyte donors; not exceeding 6 attempts in their entire life time. It further emphasized the age considered suitable for oocyte donation, suggesting donors must be at least 21 years with emotional maturity to make the decision. In Nigeria, IVF clinics are also self-regulated and in some instances unregulated as regards the practice of gamete donations. Various clinics adopt either the Human Fertilization and Embryology Authority (HFEA) or ASRM guidelines. Current efforts to unify and streamline protocols and guidelines have been proposed by the Association for Fertility and Reproductive Health (AFRH). The annual scientific meeting of the Association for Fertility and Reproductive Health, 2016, held in Port-Harcourt, Nigeria, focused on standardization and quality control in assisted reproduction. The need to adopt global best practices alongside quality control was emphasized [9].

Compensation for oocyte donors in Nigeria is determined by negotiations between the donor/ agency and the fertility clinic. However, compensation should not vary according to the planned use of the oocytes retrieved, the donor's personal characteristics or ethnicity; otherwise may lead to the term described as "oocyte paradox". Attempting to fix the fee for donor compensations has been challenged and labeled as commodification and price fixing and ASRM in 2016 had to settle a lawsuit instituted by Lindsey Kamakahi [10,11].

Access to care

A very critical issue in assisted reproduction centres on availability and affordability of fertility treatment. The current situation in Nigeria which makes fertility care available to only those who can afford it is indeed worrisome. The principle of justice focuses on the equitable distribution of benefits and risks, and for an egalitarian society, justice seems to be the key driving principle. The argument that over population is the predominant problem of developing countries, as such public health issues override other non- communicable issues is superfluous. This view is further enhanced by the classification of assisted conception as a luxury high end procedure comparable with cosmetic procedures [12]. It

therefore becomes unfair to provide solutions to biological problems only to those who can afford them.

Fertility clinics which provide assisted reproduction services were initially located in the commercial cities of Nigeria, such as Lagos, Abuja and Port-Harcourt. However in addressing the wide gap between the need for assisted reproduction services and the availability of such facilities, other centres located at less commercial cities such as Benin, Asaba, Kaduna, Ibadan, Osogbo amongst others have been established. The main limiting factor to accessing such care is the cost of the procedure currently averaging about 2000-2700 US dollars per cycle [1]. This is further compounded by the limited insurance coverage for most procedures related to fertility treatment. Denying the poor the solution to their infertility needs contradicts the principle of justice and fairness.

Another topical ethical question is "Who has the right to reproduce?" Generally, it is assumed that a married heterosexual couple in a stable relationship merits consideration for assisted reproduction. This relationship is thought to provide the most conducive environment for Child rearing. However, considerations may be given to single parents since it has been argued that legal marriage offers no guarantee of a suitable environment to raise children [12]. Others have also argued that methods employed in assisted reproduction may actually challenge the meaning of" Family", thus affecting the perception of children in such situations. In developed countries there is a propensity to treat unmarried heterosexual couples, homosexual couples and single women. In Nigeria, a country with low divorce rates, most couples presenting for assisted conception are heterosexual and legally married.

Multifetal Pregnancy Reduction (MFPR)

The ethical concerns raised are linked to that associated with abortion. Multifetal pregnancy reduction used to increase the chances of survival of higher order pregnancy is psychologically and morally demanding. The explicit intension of MFPR is not to terminate pregnancy but to increase the survival chances of the remaining fetuses. This service is rarely offered in Nigeria, since the society places a high premium on childbirth and higher order pregnancies are often desired especially amongst the infertile. However, prevention of multiple pregnancies should be preferred to MFPR. This can be achieved by ensuring few embryos are transferred at assisted reproduction. MFPR is generally acceptable if the physician has acted according to laid down regulations and tried to minimize the risk of multiple pregnancy [13]. The benefits for the remaining embryos of reducing a higher order multiple pregnancy far outweighs the disadvantage or risk of future miscarriage. The benefit of reduction of twin gestation to a singleton fetus is debatable. However may be carried out in cases of maternal disease, poor obstetric outcome and compelling social and psychological reasons [13].

Older women and in-vitro fertilization (IVF)

The major concern about treating older women is the issue of donor oocytes [14]. All forms of treatments for infertility become less efficacious with advancing maternal age and indeed age seems to be the rate limiting step in conception. In women over the age of 40 years, the take home baby rate is about 1-3% [14]. Results obtained from oocyte donation have been very good and the process poses minimal risks to the mother and baby.

An important ethical concern with the older women is parentage. Is it justifiable to treat women over the age of 50 years? Is it right for a woman to seek fertility treatment when she knows that she would not be able to cope with being a mother? Are the interests of the potential child better served by older mothers? These are issues that need to be resolved before considering older women for fertility treatment. A very careful distillation of information regarding potential risks and benefits to all parties must be considered.

It is often not acceptable to withhold treatments on the grounds of the interest of the potential child not being served.

Cross border reproductive care (CBRC)

This is a growing phenomenon involving patients crossing borders from countries of residence to other countries with the goal of receiving specific reproductive treatments not available or allowed in their country. It represents the convergence of commerce, medicine and travel. It is often referred to as reproductive tourism or exile. Drivers of CBRC include prohibition of treatment in originating country, unavailable expertise, long waiting list and exorbitant cost of treatment.

The main ethical concern here is the commodification of human parts. It encourages the sale and purchase of gametes across borders and may be subject to exploitation and transmission of genetic disorders. There is a strong moral condemnation against putting parts or products of the human body on sale [15]; only a gift is morally permissible.

HIV infection and assisted reproduction

Progress in the management of HIV has resulted in a paradigm shift in the management of infertility amongst those infected with the virus. The ethical concerns relate to the welfare of the child with regards to mother-to-child transmission of the disease and the risk of seroconversion of an uninfected spouse. Advances in medical care with accompanying increased life expectancy and reduction in vertical transmission rates using highly active anti-retroviral therapy (HAART) have led to increasing desire for procreativity among HIVpositive individuals[16].The use of HAART to suppress the viral load and obstetric modifications in labour have contributed immensely to the very low transmission to the child, which is currently less than two percent [16].

Sperm washing during assisted reproduction has significantly reduced the risk of infection transmission. It may therefore be a subject of discrimination to deny HIV positive couples who are well motivated and on HAART, the opportunity of seeking assisted reproduction. However considerations must be given to co-morbidities, intercurrent illnesses and social vices such as addiction in determining their eligibility for treatment [17].

Conclusion

Ethics frames the law within which the law is obeyed. Doing good is the ultimate goal of sound ethical principles. Diverse challenges continue to unfold with the advancement in assisted reproduction. Whilst it is difficult to exhaust all ethical dilemmas, the need to take a critical view of current challenges is not only imperative but it provides a platform for a sound discuss on areas of conflicting interests.

As the uptake of assisted reproduction increases in Nigeria, occasioned by the expanding facilities providing such treatment, there is a compelling need to examine ethical concerns on assisted conception with special attention given to the influence of environmental factors in conforming to global best practices. It is our hope that creating such platforms to consider the varied ethical concerns, especially from developing countries, would help confront the numerous ethical challenges facing our everyday practice of assisted conception.

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Workshop and conference reports should not exceed 3 to 10 double-spaced A4-sized pages. Viewpoints which could be papers expressing personal or group opinion on political, socio-economic and other matters as they relate to the practice of medicine should be limited to 10 A4-sized typed pages. Letters to the Editor may be comments on papers published in the Journal or clinical observations, replies to comments, or other matters of importance and relevance to medicine and related professions. It should not exceed 500 words with a few references and one or two tables and figures.

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References should be numbered in the order in which they are cited in the text. At the end of the article, the references should be listed as numbered in the text. Each reference should give the names and initials of all authors (unless there are more than six, when only the first three should be given, followed by *et al.*). The authors' names should be followed by the title of the article, the journal title (abbreviated according to the style of *Index Medicus)*, the year of publication, the volume number and the first and last page numbers. Titles of books should be followed by the publisher, place of publication, and year. Examples of format for references are as follows:

Edington GM, Osunkoya BO and Smith JA. Immunopathology of Burkitt's lymphoma. West Afr Med J 1986; 85: 76 – 87.

Brown A. Primary Health Care and the Medical Curriculum Edinburgh: Universities Press. 1977.

Lewis A. Primary liver cell carcinoma. In: Ajose A. Odeku EL, Eds. Priorities in Health Planning. Ibadan: University Press, 1983; 110 - 117

Reference to tables should be in Arabic numerals, e.g. Table 3, and tables should include titles, which make therein without reference to text. Tables should be typed separately from the text. Referencing within the body of the article should be in block form, i.e [1,2].

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