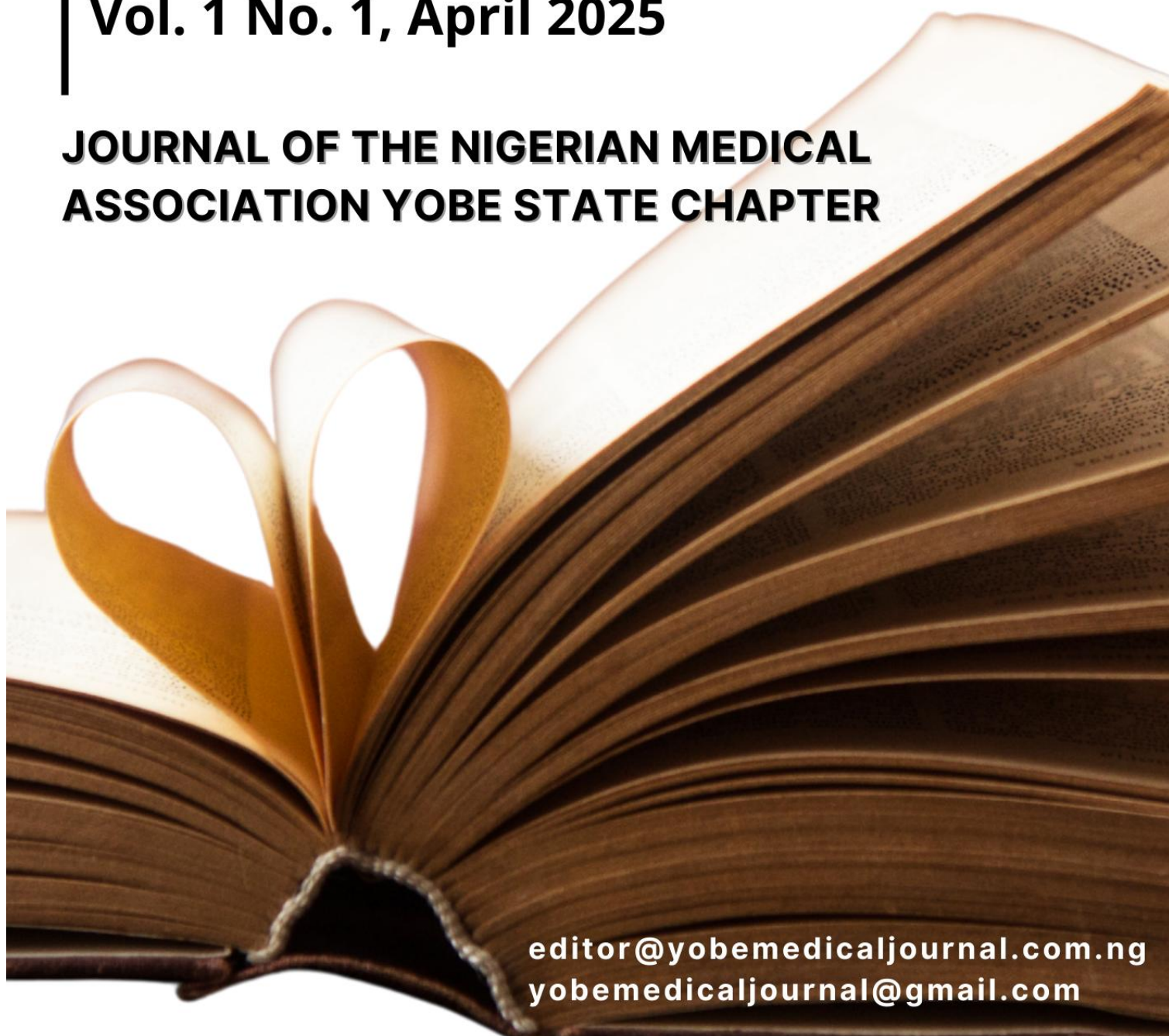




Yobe Medical Journal

Vol. 1 No. 1, April 2025

**JOURNAL OF THE NIGERIAN MEDICAL
ASSOCIATION YOBE STATE CHAPTER**



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Editorial Note

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Our journal publish original articles, review articles, case reports, letters to the editor, short communication, commentaries, viewpoints, book reviews, medical educational materials and articles on socioeconomic, political or legal matters related to medical practice.

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NMA Chairman's Remark

Esteemed Members of our Great Association, Ladies and Gentlemen

It is with immense pride, a deep sense of responsibility and fulfillment that today as the Chairman of our esteemed Association marks significant milestone in our journey—publication of the maiden edition of Yobe Medical Journal. A dream - Achieved!

We celebrate not just the launch of a publication, but the culmination of countless hours of research, dedication, and collaboration among our members. This journal embodies our commitment to advancing medical knowledge, sharing innovative practices, and fostering a vibrant dialogue within our community and beyond.

In an era where the landscape of medicine is constantly evolving, it is crucial that we document our findings, share our successes, and learn from our challenges. Our journal will serve as a platform for disseminating valuable insights, new research, and best practices that can improve patient care and health outcomes. It is a stepping stone towards a deeper understanding of the complexities of medicine.

I would like to extend my heartfelt gratitude to our editorial team, contributors, and reviewers, whose tireless efforts have made this publication possible. Your passion for excellence and commitment to our shared mission are not just commendable; they are an inspiration to us all.

As we move forward, I encourage all to contribute to this journal. Your voices, your experiences, and your research are vital to creating a comprehensive and robust resource for our medical community. Let us ensure that our journal reflects the diversity, breadth, and depth of our collective expertise.

In closing, I would like to express my optimism about the impact this journal will have—not only within our Association but in the broader medical field. Together, we are not just practitioners; we are pioneers, innovators, and educators dedicated to the betterment of healthcare.

Thank you All and Let the journey of Yobe Medical Journal begin!

Congratulations to us All

Dr Usman Waziri
NMA Chairman
(2024-2026 Exco-Year)

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2. Short research notes

These are single-finding articles that can be reported with not more than two illustrations/figures/tables. Posters from conferences or internal meetings may be written as short research notes. Some additional detail in the methods, description of the results, and discussion may be required to enable readers have enough information to understand the description of the work. A Short research note should follow the structure of Abstract, Introduction, Methodology, Results, Discussion, Conclusion, Acknowledgements, Authors' contributions, Competing Interests, Funding, Consent (where applicable), Ethical approval (where applicable), and References. This should not exceed 2,500 words, 3 illustrations/figures/tables, and 30 references.

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5. Systematic review articles

These are usually based on medical interventions or animal model studies. Authors should consult the PRISMA guidelines for reporting in systematic reviews. Systematic reviews deal with a clearly formulated question and use systematic and explicit methods to identify, select, and critically assess the relevant research. The sections on Acknowledgements, Authors' contributions, Competing Interests, Funding, Consent (where applicable), Ethical approval (where applicable), and References should be included. These articles should not exceed 6,000 words, 50 references and 12 illustrations/figures/tables.

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These describe patient cases which are of particular interest due to their rarity, peculiarity, novelty and their potential message for clinical practice. These demonstrate unusual presentations which may confront the practitioner. Case reports should follow the structure of Abstract, Introduction, Case presentation, Discussion, Conclusion, Acknowledgements, Authors' contributions, Competing Interests, Consent (where applicable), Ethical approval (where applicable), and References. A case report should not exceed 2,500 words, 5 figures and 30 references.

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These include a comment on a newly published article in the Yobe Medical Journal or a short

narrowly focused article on a topical issue of public interest; usually invited by the journal editor. It should not exceed 1,500 words, 2 illustrations/figures/tables, and 30 references.

8. Perspectives

These present criticism or address controversy about a recently published paper, a current/ ongoing area of scientific research, or a newly implemented innovation. They are written to present the author's insights and include both original data and personal opinion. Perspectives should follow the structure of Abstract, Introduction, Body, and Conclusion. It should not exceed 2,500 words, 2 illustrations/figures/tables, and 30 references.

9. Viewpoints/ Opinion articles

These highlight the strength and weaknesses about a specific topic or concept, hypothesis or scientific theory. They are written to present the author's personal opinions and ideas on the subject and do not contain original data. Viewpoints/ Opinion articles should follow the structure of Abstract, Introduction, Body, and Conclusion. It should not exceed 2,500 words, 2 illustrations/figures/tables, and 10 references.

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This provides a background, defined problem, proposed solution, brief literature survey and justification of the research.

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DURATION OF HOSPITAL STAY: A COMPARISON OF PROPHYLACTIC SINGLE DOSE AND MULTIPLE DOSES OF AMOXICILLIN-CLAVULANIC ACID IN ELECTIVE CAESAREAN SECTION IN BAUCHI, NIGERIA

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ABSTRACT

Background: The mean duration of hospital stay due to infections following caesarean deliveries are important and substantial cause of maternal morbidity and increase the cost of treatment as the rate of caesarean section increases worldwide. Antibiotic prophylaxis has been shown to reduce surgical site infections and duration of hospital stay in caesarean section.

Objective: To determine the duration of patients' stay in the hospital by comparing the effectiveness of single-dose and multiple-dose regimen of Augmentin for chemoprophylaxis in elective caesarean sections in Bauchi, Nigeria.

Methods: A randomized controlled study among 114 participants was conducted, in which participants were randomly allocated into Group I and Group II. Participants in Group I and II received a single intravenous dose of 1.2g Augmentin within 60 minutes of the procedure, then group II followed by 625mg of Augmentin twice daily for 7 days. Both groups were followed for 30 days and were assessed for duration of hospital stay as primary outcome. Data were analysed using an independent student's t-test using SPSS version 23.0 with a 5% alpha level of significance.

Result: The study showed that 83.9% of patients in group I and 81.8% of patients in group II had no prolonged hospital stay. However, 16.1% of patients in group I and 18.2% of patients in group II had prolonged hospital stay. There was no statistically significant difference in the mean duration of hospital stay between the two groups ($p=0.89$).

Conclusion: This study revealed no statistically significant difference in the mean duration of hospital stay (in days) between the two groups when a preoperative single dose of amoxicillin-clavulanic acid was compared with additional 7days course of prophylactic antibiotic following elective Caesarean section in Bauchi.

Keywords: Duration of hospital stay, Caesarean section, Amoxycillin-clavulanic acid doses, Bauchi

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INTRODUCTION

The mean duration of hospital stay due to infections following Caesarean deliveries is a significant contributor to maternal morbidity, substantially increasing treatment costs. This concern is heightened by the rising global rate of Caesarean sections. Notably, women undergoing Caesarean delivery are 5-20 times more likely to develop infections compared to those who have vaginal deliveries.¹ Women undergoing caesarean delivery are at 5-to-20-fold greater risk of infection than the women undergoes vaginal delivery. Infections following caesarean deliveries are important and substantial causes of maternal morbidity and increase in hospital stay and cost of treatment.²

The single most important risk factor for postpartum maternal infection is caesarean delivery². The other factors associated with increased risk of maternal infection includes; pre-existing maternal conditions (e.g. malnutrition, diabetes, obesity, severe anaemia, bacterial vaginosis) and spontaneous or provider-initiated conditions during labour and childbirth (e.g premature rupture of membranes, multiple vaginal examinations, manual removal of placenta).³The incidence of post-caesarean delivery infection varies world-wide from 1.1% to 25% compared with 0.2%to 5.5% following vaginal birth.¹

The post-caesarean infections are polymicrobial, involving aerobes, anaerobes, and ureaplasma. The major source of postpartum infection after caesarean delivery is the lower genital tract especially when the membranes are ruptured, but this still occurs with an intact membrane following preterm delivery. The most commonly isolated pathogens are anaerobes and gram-positive aerobes. The gram-negative aerobes include *Escherichia coli*, *Klebsiella* species, and *Proteus* species. The anaerobes include *Bacteroides* species, *Clostridium* species and *Fusobacterium* species.⁴

Surgical antibiotic prophylaxis is defined as the use of antibiotic to prevent infection at operation site⁵. A number of well-designed studies have documented the efficacy of antibiotic prophylaxis

in reducing the rates of postpartum infection in women who have undergone caesarean delivery⁴. The administration of antibiotics is not intended to sterilize tissues but to act as an adjunct to reduce the intraoperative microbial load to a level which can be managed by host immune responses. The goal of antibiotic therapy is to achieve sufficient tissue level at the time of microbial contamination. The optimal agent should be long-acting, inexpensive and have a low side effect profile⁶. Administration of antibiotic prophylaxis within an hour prior to skin incision is more effective in decreasing the post-caesarean infectious morbidity when compared to administration of the same drugs after cord-clamping and has no effect on neonatal infection⁴.

The current debate focuses on the optimal antibiotic agent to use, with most obstetricians preferring single agent, the type of antibiotic to be used and single versus multiple doses⁷. WHO recommended that for the caesarean section, a single dose of first generation cephalosporin or penicillin should be used in preference to other antibiotics. Prophylactic antibiotics should be administered, for maximal benefit, 30-60minutes before skin incision rather than intra-operatively after cord-clamping. Antibiotics are still beneficial when used outside the suggested time frame and should be applied when the available time to administer a prophylactic antibiotic might be limited (e.g. emergency caesarean section).³

Despite the evidence showing the single dose to be as effective as the multiple doses's regimens, recent trials suggested multiple doses of an extended spectrum antibiotic regimen may reduce infectious complications. Furthermore, recent surveys report are inconsistent and showed variable application of antibiotic prophylaxis in caesarean section world-wide⁷. Similarly, in Nigeria, anecdotal evidence suggest that there is no uniformity in adherence to evidence-based practice among obstetricians performing caesarean section in terms of timing and duration of prophylaxis.⁵ In low resource settings, various aspects include lack of sufficient infrastructure in operating rooms, lack of optimal asepsis, absence of clear aseptic technique, re-use of disposable materials, challenges in postoperative follow up after discharge from hospital, patient level of

education to maintain their hygiene, dictate the use of extended antibiotic prophylaxis after emergency and even elective caesarean section by many health professionals. Prolonged and inappropriate use of antibiotics for prevention of surgical site infection has been shown to be associated with emergence of antibiotic resistance and increased health care cost.⁵

Consequently, we lack evidence-based standardized protocols to guide the duration of antibiotic prophylaxis after caesarean section in low resource settings. Considering the consequences of inappropriate use of antibiotics and lack of evidence-based consensus about a clear protocol in low resource setting, comparing single and multiple dose antibiotic prophylaxis in uncomplicated caesarean section is worthy to be done¹.

The purpose of this study is to determine the duration of patients stay in the hospital by comparing the effectiveness of single dose and multiple doses of Augmentin for chemoprophylaxis in elective caesarean section in Bauchi, Nigeria. The hope is that the findings may change our policy of antibiotic prophylaxis for the caesarean section, with attendant cost reduction and savings in nursing time.

METHODS

Study area

The study was conducted at Bauchi in Abubakar Tafawa Balewa University Teaching Hospital in north eastern Nigeria. The hospital delivers about 4000 women annually, with a caesarean section rate of 33.04% and about 6.56 % of caesarean sections are elective operations.

Study design

A randomized controlled trial was used.

Study population

Pregnant women admitted in the Antenatal ward of the Hospital, for elective caesarean section for various indications were included and those with known hypersensitivity to Amoxycillin-clavulanic acid or penicillin 2 weeks prior to

surgery, presence of chorioamnionitis, diabetes mellitus, obesity and women >85 kgs, HIV in pregnancy, prolonged pre-operative hospitalization and established labor were excluded.

Sample size calculation

The minimum sample size was determined using the formula for comparison of proportions using the mean duration of hospital stay from a previous study 7%⁹ with $Z_{\alpha} = 1.96$, the probability of type II error (β) of Power set at 80%=0.84. After Adding 10% expected attrition, a total of 57 subjects were required in each group with the total sample size of 114.

Sampling technique

Pregnant women who satisfied the eligibility criteria and consented to participate in the study were randomized into two groups: Group I and Group II.

Fifty-seven small pieces of paper were marked group I and another 57 were marked group II. These pieces of papers were then mixed thoroughly and each placed in serially numbered 114 opaque envelopes (Randomization) which were kept in a box. Allocation was done by opening a sealed opaque envelope. The sealed envelopes were secured and kept in the antenatal ward. The matron in the ward who was otherwise not involved in the study opened the envelopes serially as the patients were brought in until the completion of the study. Neither the surgeon nor the participants were aware of the allocation of participants to any group prior to opening the envelopes (Allocation concealment).

Group I (Study group)

This group is comprised of 57 patients. Each patient received a single dose of 1.2g of amoxicillin-clavulanic acid intravenously. The dose was administered by the anesthetist within 60 minutes before the skin incision. To reconstitute, 20mls of sterile water for injection was added to a vial of 1.2g of amoxicillin-clavulanic acid, then this was administered intravenously over 3-4 minutes within 20minutes of reconstitution. No additional antibiotics were

given. Those who developed infectious morbidity were evaluated and managed.

Group II (Control group)

This group is comprised of 57 patients. Participants in this group received a single intravenous dose of 1.2g Amoxicillin-clavulanic acid within 60 minutes prior to the procedure, followed by 625mg of oral Amoxicillin-clavulanic acid twice daily for 7 days, commencing as soon as oral intake was tolerated.

Data collection method

Data was collected using structured pre-tested interviewer questionnaires by trained research assistants after obtaining an informed consent from the pregnant women.

Postoperative follow up

Patients in both groups received standard postoperative care for Caesarean section, following our department's established protocol, with the exception that wound inspection for signs of infection occurred on the third postoperative day. Patients were assessed daily for the above outcomes. Those patients who were well on day three or day seven (depending on the type of skin incision used) were discharged. Patients found to have wound infection were kept on admission for evaluation and treatment.

After discharge every patient was instructed to report to the hospital if they develop symptoms like fever, foul smelling vaginal discharge, bleeding per vaginum, discharge from the surgical site, and breast engorgement within two weeks of discharge or to come to the hospital for follow up at two weeks. Patients were followed for 30days.

Data analysis

Data obtained was entered into an excel sheet then analyzed using SPSS version 25.0.

Quantitative variables were described using means and standard deviation while qualitative variables were described as percentages. Continuous (Quantitative) variables were analyzed using independent sample t test, and the results were presented in tables and charts. P value < 0.05 was considered statistically significant.

Ethical consideration

An approval for the study was obtained from the Health Research Ethics Committee of the Hospital and registered with Pan African clinical trial registry before commencement of the study. Patients were fully informed by the investigators about the aims and procedures of the study and its potential risks and benefits. Following this, written informed consents were obtained from the patients that participated in the study.

RESULTS

The response rate was (98.2%) in Group I and (96.4%) in Group II with attrition of (1.8%) in Group I and (3.6%) in Group II respectively among 114 participants, 57 in each group.. The mean age \pm SD of the patients in Group I and Group II were 29.3 ± 5.45 and 29.8 ± 5.35 years respectively. ($t = -0.485$, $p = 0.63$). The mean gestational age in weeks \pm SD at the time of CS was 38 ± 1.65 and 38 ± 1.4 in Group I and Group II respectively ($t = -1.314$, $p = 0.19$). Fifty-five (98.2%) and 53 (96.4%) patients were booked in Group I and Group II respectively ($p = 0.62$). Majority of patients in both groups had secondary level of education which was 60.7% and 60.0% for group I and II respectively ($p = 0.99$), there was no statistically significant difference in the socio-demographic characteristics of the patients.

The mean preoperative hemoglobin in group I was $11.23\text{g/dl} \pm 0.76$, while it was $11.62\text{g/dl} \pm 1.08$ in group II ($p = 0.05$).

Table 1: General Characteristics of the respondents

| VARIABLES | GROUP1 FREQ. (%) | GROUP2 FREQ. (%) | χ^2 | p-value |
|--|---------------------|---------------------|----------------|---------|
| Age group (years) | | | | |
| ≤ 19 | 3 (5.4) | 0 (0.0) | Fisher's Exact | 0.62 |
| 20-24 | 8 (14.3) | 8 (14.5) | | |
| 25-29 | 14 (25.0) | 16 (29.1) | | |
| 30-34 | 21 (37.5) | 20 (36.4) | | |
| ≥ 35 | 10 (17.9) | 11 (20.0) | | |
| Total | 56 (100.0) | 55 (100.0) | | |
| Mean ± SD | 29.3 ± 5.45 | 29.8 ± 5.35 | t = -0.485 | 0.63 |
| Parity | | | | |
| < 1 | 8 (14.3) | 4 (7.3) | 1.90 | 0.37 |
| 1-4 | 40 (71.4) | 45 (81.8) | | |
| > 4 | 8 (14.3) | 6 (10.9) | | |
| Total | 56 (100.0) | 55 (100.0) | | |
| Median (IQR) | 2(1.75) | 2(2) | | |
| Estimated gestational age (weeks) | | | | |
| < 37 | 5 (8.9) | 4 (7.3) | Fisher's Exact | >0.99 |
| 37-41 | 51 (91.1) | 51 (92.7) | | |
| > 41 | 0 (0.0) | 0 (0.0) | | |
| Total | 56 (100.0) | 55 (100.0) | | |
| Mean ± SD | 38 ± 1.65 | 38 ± 1.40 | t = -1.314 | 0.19 |
| Maternal weight (kg) | | | | |
| < 50 | 1 (1.8) | 1 (1.8) | Fisher's Exact | 0.22 |
| 50-59 | 15 (26.8) | 13 (23.6) | | |
| 60-69 | 28 (50.0) | 20 (36.4) | | |
| 70-79 | 12 (21.4) | 21 (38.2) | | |
| Total | 56 (100.0) | 55 (100.0) | | |
| Mean ± SD | 64.1 ± 7.38 | 65.7 ± 8.75 | t = -1.04 | 0.30 |

| | | | | |
|--------------------------------|-------------|-------------|----------------|-------|
| Booking status | | | | |
| Booked | 55 (98.2) | 53 (96.4) | Fisher's Exact | 0.62 |
| Un-booked | 1 (1.8) | 2 (3.6) | | |
| Total | 56 (100.0) | 55 (100.0) | | |
| Educational status | | | | |
| Primary | 5 (8.9) | 4 (7.3) | Fisher's Exact | >0.99 |
| Secondary | 34 (60.7) | 33 (60.0) | | |
| Tertiary | 17 (30.4) | 18 (32.7) | | |
| Total | 56 (100.0) | 55 (100.0) | | |
| Previous c/s delivery | | | | |
| 0 | 16 (28.6) | 19 (34.5) | Fisher's Exact | 0.33 |
| 1 | 9 (16.1) | 13 (23.6) | | |
| 2 | 21 (37.5) | 14 (25.5) | | |
| 3 | 10 (17.9) | 7 (12.7) | | |
| 4 | 0 (0.0) | 2 (3.6) | | |
| Total | 56 (100.0) | 55 (100.0) | | |
| Pre-operative HB (g/dl) | | | | |
| <10 | 1 (1.8) | 0 (0.0) | Fisher's | >0.99 |
| ≥10 | 55 (98.2) | 55 (100.0) | Exact | |
| Total | 56 (100.0) | 55 (100.0) | | |
| Mean ± SD | 11.2 ± 0.76 | 11.6 ± 1.08 | t = -1.982 | 0.05 |

Figure 1 showed the duration of hospital stay. Eighty-three percent of patient in group I and 81.8% of patient in group II had no prolonged hospital stay. Only 16.1 % of patient in group I and 18.2% of patient in group II had prolonged hospital stay. There was no statistically significant difference in the mean duration of hospital stay in days between the two groups (4.6 and 4.5, $t = 0.143$, $p = 0.89$).

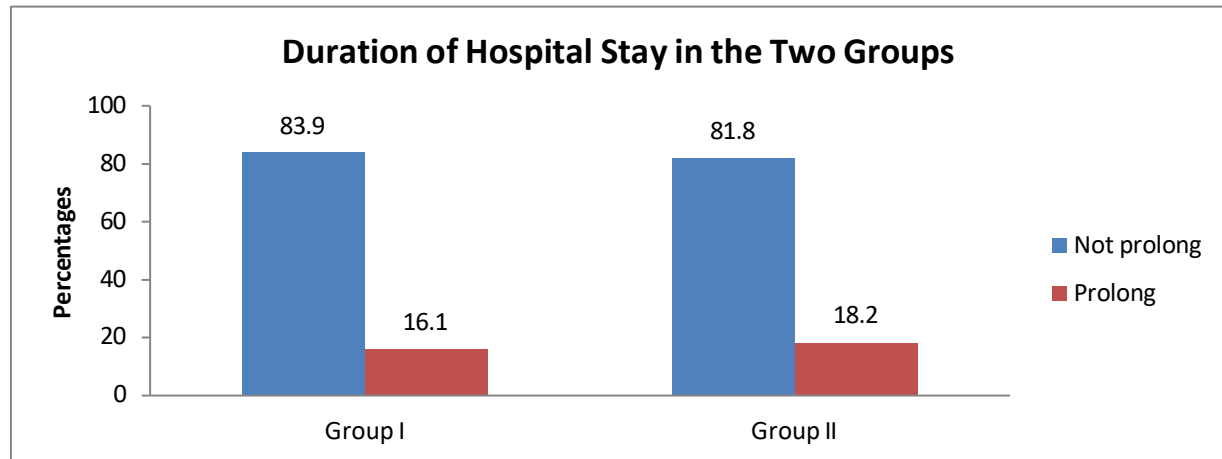


Figure 1: Duration of Hospital stay in the two groups

Table 2 showed the reason for prolonged hospital stay among the patients in the two groups. One patient in Group I that had wound infection had a prolonged hospital stay of 17days and the other patient that had wound infection was discharged on day 4. However, the patient developed wound infection after discharge. The one patient that developed wound infection in Group II had prolonged hospital stay of 19days. The other reasons for the prolonged hospital stay were hypertension, anaemia and others. However, there was no statistically significant difference between the two groups ($p = 0.10$)

Table 2: Reasons for prolonged hospital stay

| Variables | Group I | Group II |
|-----------------|---------|----------|
| Wound infection | 2 (3.6) | 1 (1.7) |
| Hypertension | 0 (0.0) | 5 (9.1) |
| Anaemia | 3 (5.4) | 3 (5.4) |
| Others | 5 (9.0) | 3 (5.4) |

Figure 2 showed the microbiological pattern of the infections in the two groups. The pattern of wound infection revealed *Staphylococcus aureus* as the commonest organism responsible for wound infection accounting for 2 wound infections (66.7%) and *Klebsiella oxytoca* accounting for 1 (33.3%) of the wound infection. *Staphylococcus aureus* is responsible for the two wound infections, one in each group, while *Klebsiella* was the organism implicated in the second patient with wound infection in Group I. *Staphylococcus aureus* had sensitivity to Ampiclox and Ciprofloxacin in both patients while *Klebsiella* showed sensitivity to Methicillin, Levofloxacin, Ofloxacin and Gentamicin.

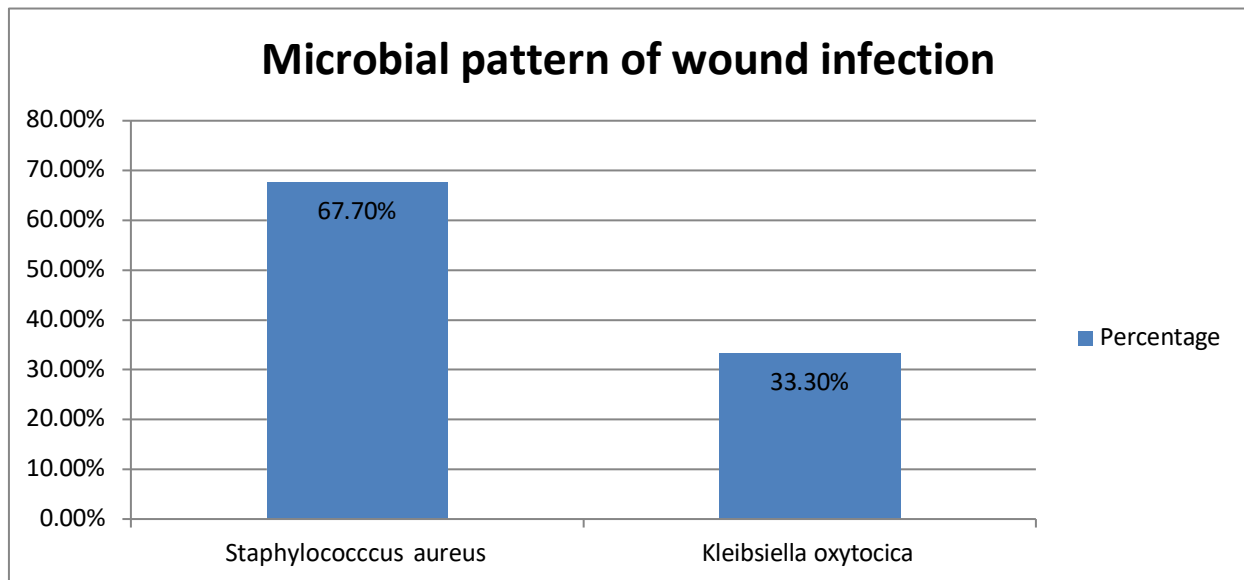


Figure 2: Microbial pattern of wound infection

DISCUSSION

In this study, there was no statistically significant difference in the general characteristics, indications for CS and operative characteristics between the study and the control groups. This shows that the two groups were comparable and variations in outcome measures would be because of difference in antibiotics administered.

This study demonstrated no statistically significant difference in the mean duration of hospital stay in days between the two groups. This is similar to the findings in Mozambique and Pakistan.^{11,12} The duration of hospital stay is prolonged in 17.3% of patient in Group I and 19.6% of patient in Group II. The patient in Group I with infectious morbidity had longer duration of hospital stay which is statistically different from those that didn't have wound infection ($p = 0.003$). Patient in Group II with infectious morbidity had longer duration of hospital stay which is statistically ($p = 0.16$)

compared to those without wound infection. It is considered that the onset of SSI doubles the normal stay in hospital and costs for that operation. Study in the United State showed that SSI prolonged hospital stay by 7.3 days with additional cost of 3200 dollars thereby significantly impacting healthcare costs and resource utilization.¹³

CONCLUSION

This study revealed no statistically significant difference in the mean duration of hospital stay in days between the two groups when preoperative single dose amoxicillin-clavulanic acid was compared with additional 7 days course of prophylactic antibiotic following elective caesarean section at ATBUTH.

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Conflict of interest

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THE VALUE OF DEXAMETHASONE IN SPINAL BLOCK FOR LOWER LIMB ORTHOPEDIC SURGERY

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ABSTRACT

Background: adjuvants are not only used to potentiate analgesic effect of local anaesthetic agents but also to reduce the side effects and complication that may arise during regional anaesthesia. Many were tried to improve efficacy of local anaesthetic agents but are not without complication. The aim of this study was to determine and compare incidence of complications with the use of hyperbaric bupivacaine alone and combination with dexamethasone in spinal anaesthesia for lower limb surgery.

Methodology: This was a prospective double blinded randomized study. It involved 68 consented ASA I and II patients, aged 18-75 years scheduled for lower limb ORIF. Ethical approval was obtained, NHREC/25/10/2013. Patients were randomly allocated. Monitoring of haemodynamic parameters was done. The data analyzed using SPSS. Student T test was used to compare the quantitative variables while Chi-squared (χ^2) test was used to compare the qualitative variables. Results were presented in the form of figures and $p < 0.05$ was regarded as statistically significant.

Results: The mean preoperative haemodynamic parameters of the patients were not statistically significant. The incidence of hypotension was 24.60% and 4.61% in group BA and BD respectively with $p = 0.001$. Bradycardia were 7.70% and 0.00% in group BA and BD respectively, with $p = 0.003$ which was also statistically significant. For Inadequate block; 3.10% and 1.54% for groups BA and BD respectively, with $p = 0.15$ showing no significant difference, while for nausea; was 09.20% and 4.62% for BA and BD respectively, with no significant difference, $p = 0.26$. There was only one patient in Group BA that had shivering and none in group BD.

Conclusion: This study revealed that addition of 4 mg dexamethasone to 10 mg of 0.5% heavy bupivacaine was found to be associated with fewer incidences of complications compared with the use of 10 mg 0.5% heavy bupivacaine alone in spinal anaesthesia for lower limb ORIF in the immediate postoperative period.

Keywords; unilateral spinal anaesthesia, complications, dexamethasone

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INTRODUCTION

Unilateral spinal anesthesia is a technique that exclusively blocks the sensory, motor and sympathetic functions on one side of the body and offers the advantages of a spinal block without the typical adverse side effects seen with a bilateral spinal block.¹ Intrathecal local anaesthetics have been found to be associated with limited duration of action, hypotension, bradycardia, nausea and vomiting, urine retention, high spinal and total spinal anaesthesia.² Adjuvants are not only used to potentiate analgesic effect of local anaesthetic agents but also to reduce the side effects and possible complication that may arise during regional anaesthesia.³ Many adjuvants were used to obtund such effects; opioids,⁴ adrenaline,⁵ dexmedetomidine,⁶ clonidine,⁷ ketamine,⁸ midazolam,⁹ neostigmine,¹⁰ and magnesium sulphate.¹¹ However, all these adjuvants were not without complications. Respiratory depression was seen with opioids, hypertension and tachycardia with ketamine, sedation as observed with clonidine and dexmedetomidine, while secretion was seen with the use of neostigmine and ketamine. The purpose of this study was to determine whether the addition of dexamethasone to intrathecal bupivacaine would prevent such complications or not during unilateral spinal anaesthesia for lower limb open reduction and internal fixation.

MATERIALS AND METHOD

The study was carried out at Federal Teaching Hospital Gombe, Gombe state, Northeastern part of Nigeria. This was a prospective experimental study that involved adult patients between the age of 18-75 years of American Society of Anesthesiologists (ASA) physical status I and II that fulfilled the inclusion criteria and were scheduled for unilateral lower limb ORIF at Federal Teaching Hospital Gombe, Gombe state, Nigeria. The data was collected over a period of 6 months with subsequent data cleaning. The study was conducted in a randomized double-blind manner. Patients were allocated to a group according to the drugs to be injected by picking a paper from a sealed

envelope which carried an equal number of BA (who received 10 mg of 0.5% intrathecal hyperbaric bupivacaine 2ml with 1ml of normal saline) and BD (who received 10 mg of 0.5% intrathecal hyperbaric bupivacaine 2ml with 4mg, 1ml dexamethasone) in the pre-anaesthetic room. It was prepared by a trained research assistant who was not involved in any other perioperative management of the patients. All the drugs were in 5ml syringe containing 3ml of prepared drugs.

Sample size estimation: The minimum sample size (n) for this study was calculated using the formula by Charan et al.¹² The Standard deviation of the duration of the pain-free period was 72.64 in the Dexamethasone group using the study by Bani-Hashem et al.¹³ This calculation resulted in a sample size of 31.

Thus, 31 subjects were recruited in each group. To allow for 10% attrition, the sample size of each group was made up to 34, resulting in a total number of 68 subjects for the entire study.

All consenting subjects aged 18-75 years, with ASA status of I and II who were scheduled for unilateral lower limb ORIF, and who had no contraindications, were included in the study

All subjects who were ASA III and above, diabetic, had evidence of cardiovascular disease or disease/injuries of the vertebral column were excluded from the study. Subjects who had local or systemic infection, who were on chronic steroid therapy, had neurological deficits or psychiatric illnesses were also excluded. Un-cooperative patients, patients with allergies to bupivacaine, those with other contraindications to spinal anaesthesia, history of drug addiction or alcohol abuse as well as those with partial block on the contra-lateral limb, inadequate block or failed block were all excluded from the study.

Ethical issues: Ethical approval was obtained on 1st December, 2020 from the Health Research and Ethics Committee (HREC) of Federal Teaching Hospital, Gombe NHREC/25/10/2013. Written informed consent was obtained from each patient after adequate

counselling and an information note was given to each subject and their relations for clarity.

ANAESTHETIC MANAGEMENT: all patients booked for ORIF, whose names were on the surgery list were seen a day before surgery, to confirm diagnosis, establish rapport, allay anxiety and assess their clinical condition. The subjects were optimised and pre-medication prescribed including the establishment of fasting guideline and informed consent. The socio-demographic data of the subjects were collected, including age, sex, height, weight and BMI. Baseline vital signs, including pulse rate, blood pressure, respiratory rate, temperature and oxygen saturation were documented. Relevant investigation results were reviewed and documented. The Patient's physical status was assigned according to the American Society of Anesthesiologists (ASA) and physical status classification. Fasting guidelines were established based on 8, 6, and 4 hours for solid, semi-solid and clear fluid respectively. Oral benzodiazepine diazepam 5-10 mg was prescribed based on the patient's anxiety. Patient was educated how to use VAS (visual analogue score). On the day of surgery, patient was randomly allocated to either Group BA or BD according to the drugs to be injected, by picking a paper from a sealed envelope which carried an equal number of BA and BD in the pre-anaesthetic room.

INTRAOPERATIVE MANAGEMENT: a quick check for the availability and functionality of the anaesthetic machine and other essential anaesthetic equipments was carried out. In the operating room, the patient was placed on the operating table, the multi-parameter patient monitor was attached to the patient and the baseline vital signs were taken and documented. Subsequently, the patient was monitored for heart rate (HR), non-invasive blood pressure (NIBP), oxygen saturation (SPO₂), temperature and ECG. Intravenous access was secured using a size 18G cannula and Ringers lactate was given at 15 mls per kilogram body weight over 20 minutes as preloading and all the patients in both groups were given intravenous short-acting opioid, fentanyl at the dose of 1.5 mcg per kilogram body weight but not more than 100 mcg to position the patient well without much pain. Patients were placed in lateral position with the limb to

be operated on in the dependent position. The vertebral column position was accurately visualized and maintained as horizontal as possible. The back of each patient was prepared with antiseptic lotion and the patient was draped aseptically. A skin wheal was raised with an injection of 2 mls solution of lidocaine 1% at the plane of needle puncture at L3/L4 intervertebral space. That level was identified by an imaginary line passing through the two iliac crests (Tuffier's line). Lumbar puncture was performed at the same level in the centre with a 25G disposable Whitacre spinal needle with bevel facing the dependent side. After a free flow of clear cerebrospinal fluid is seen, an injection of 10 mg of 0.5% bupivacaine (2 mls) diluted with preservative-free normal saline (1ml) made up to 3.0 mls was administered slowly to those in group BA while 2 mls (10 mg) of 0.5% heavy bupivacaine mixed with 4 mg (1ml) of dexamethasone making a total of 3.0 mls was administered slowly to those in group BD. The needle was removed at once and the punctured site was covered with sterile gauze and plastered. The patient was kept in the lateral position for twenty (20) minutes and then turned supine for the procedure. The sensory block was evaluated using temperature discrimination (by application of 'cold' alcohol skin prep) after the end of the injection. The dermatomal level was tested every two minutes till the level stabilized for four (4) consecutive tests then every five (5) minutes till thirty (30) minutes, then every 15 minutes until the point of regression of the sensory level to L3 on the dependent side.

The motor block was evaluated using the Bromage scale at the time reaching the peak of sensory level on the operated and non-operated limb, and time to complete recovery of motor block was noted. HR, NIBP, mean arterial blood pressure (MAP), respiratory rate (RR) and ECG were recorded for every one (1) minute in the first 15 minutes, then every five (5) minutes for the remaining period of the surgery. The onset time was defined as the time interval between the end of injection of the drug into the intrathecal space and the time patient has total abolition of response to 'cold' at T10 on a target limb with a complete response on the other limb.

DATA ANALYSIS: All the data obtained were analyzed using statistical package for social sciences (SPSS Chicago, USA). Student T test was used to compare the quantitative variables while Chi-squared (X^2) test was used to compare the qualitative variables. Results were presented in the form of tables, figures and graphs and $p < 0.05$ was regarded as statistically significant.

DEFINITIONS: Hypotension: is a decrease in systolic arterial blood pressure by over 20% or diastole 15% compared to the baseline value.

Bradycardia: reduction in heart rate by 20% from the baseline.

Respiratory depression: defined as respiratory rate ≤ 8 cpm,

High and total spinal: these manifest with loss of consciousness, apnoea and hypotension as a result of the high level of the block. It occurs when the level of sensory block extends to the second/third thoracic or cervical dermatomes.

Failed block: occurs when there is no sensory block, VAS ≥ 4 or Bromage score > 2 on the target limb 20 minutes after giving the unilateral spinal block.

Inadequate block: occurs when the motor block based on the Bromage score is 2 on the target limb after 20 minutes from the onset time.

RESULTS

A total of sixty-eight (68) ASA I and II patients aged between 18-75 years who had unilateral lower limb ORIF at the Federal Teaching Hospital Gombe, were recruited for this study, which lasted for eleven months. The mean age of the patients in group BA was 39.97 ± 11.22 and BD was 39.12 ± 12.37 years, $p = 0.77$.

The male to female ratio for groups BA and BD were 19:15 and 21:13 respectively, $p = 0.64$ as shown in table I. The mean preoperative haemodynamic parameters of the patients were not statistically significant as shown in table II. The mean onset time for sensory block were 4.48 ± 1.44 minutes and 4.44 ± 0.88 minutes in groups BA and BD respectively, $p = 0.92$. While the mean onset time for the motor block were 7.24 ± 2.09 minutes and 6.59 ± 1.56 minutes for groups BA and BD respectively, $p = 0.16$. The mean VAS score in the first two hours were not significant. However, in the third hour, the mean VAS was 2.97 ± 1.00 and 0.18 ± 0.56 ($p = 0.001$), fourth hour was 2.85 ± 1.58 and 0.94 ± 1.34 ($p = 0.001$) and the eighth hour was 1.79 ± 0.41 and 3.82 ± 1.49 ($p = 0.001$) which were statistically significant. The intra-operative complications observed during the study were hypotension, bradycardia, inadequate block, nausea and shivering. Those that had hypotension were 16 (24.60%) and 03 (4.61%) patients in group BA and BD with $p = 0.001$. This showed a statistically significant difference. Bradycardia were 05 (7.70%) and 0 (0.00%) in group BA and BD respectively, with $p = 0.003$ which was also statistically significant. For Inadequate block, 2 (3.10%) and 01 (1.54%) for groups BA and BD respectively, with $p = 0.15$ showing no significant difference, while the patients that had nausea; were 06 (9.20%) and 03 (4.62%) for BA and BD respectively, with no significant difference, $p = 0.26$. One of the subjects in Group BA experienced shivering. The mean dose of Ephedrine given in those that had hypotension was 3.889 ± 1.906 and 5.500 ± 3.969 for groups BA and BD respectively with no significant difference ($p = 0.26$). There were no statistically differences in the postoperative PR, SBD, DBP, MAP, SPO₂ and RR between the two groups, as shown in table II.

Table I: Comparison of socio-demographic data of the patients

| Variable | Group BA Mean \pm S.D | Group BD Mean \pm S.D | p-value |
|--------------------------|----------------------------|----------------------------|---------|
| Age (years) | 39.97 \pm 11.22 | 39.19 \pm 12.37 | 0.77 |
| Weight (Kg) | 62.73 \pm 10.20 | 64.68 \pm 8.25 | 0.39 |
| Height (m) | 1.67 \pm 0.08 | 1.68 \pm 0.94 | 0.70 |
| BMI (Kg/m ²) | 22.85 \pm 3.55 | 23.35 \pm 3.79 | 0.58 |
| ASA I | 24(35.30%) | 26(38.20%) | 0.58 |
| ASA II | 10(14.70%) | 08(11.80%) | |
| SEX (M:F) | 19:15 | 21:13 | 0.64 |

BA: bupivacaine alone, BD: bupivacaine with dexamethasone, SD: standard deviation, p-Value <0.05 statistically significant. BMI: body mass index, ASA: American society of anaesthesiologists, M: F male to female ratio

Table II: Comparison of mean preoperative haemodynamic parameters of the subjects

| Variable | Group BA Mean \pm S.D | Group BD Mean \pm S.D | p-value |
|----------------------|----------------------------|----------------------------|---------|
| HR (b/min) | 85.125 \pm 5.51 | 85.36 \pm 4.14 | 0.84 |
| SBP (mmHg) | 124.5 \pm 4.89 | 123.52 \pm 4.60 | 0.08 |
| DBP (mmHg) | 82.10 \pm 5.11 | 79.36 \pm 7.56 | 0.09 |
| MAP (mmHg) | 94.13 \pm 17.06 | 93.18 \pm 5.63 | 0.69 |
| SPO ₂ (%) | 99.18 \pm 0.99 | 99.71 \pm 0.72 | 0.08 |
| RR (cycle/min) | 18.00 \pm 0.888 | 18.235 \pm 1.103 | 0.34 |

BA: bupivacaine alone, BD: bupivacaine with dexamethasone, SD: standard deviation, p- value <0.05 statistically significant. SBP: systolic blood pressure, DBP: diastolic blood pressure, MAP: mean arterial pressure, RR: respiratory rate, SPO₂:

oxygen saturation

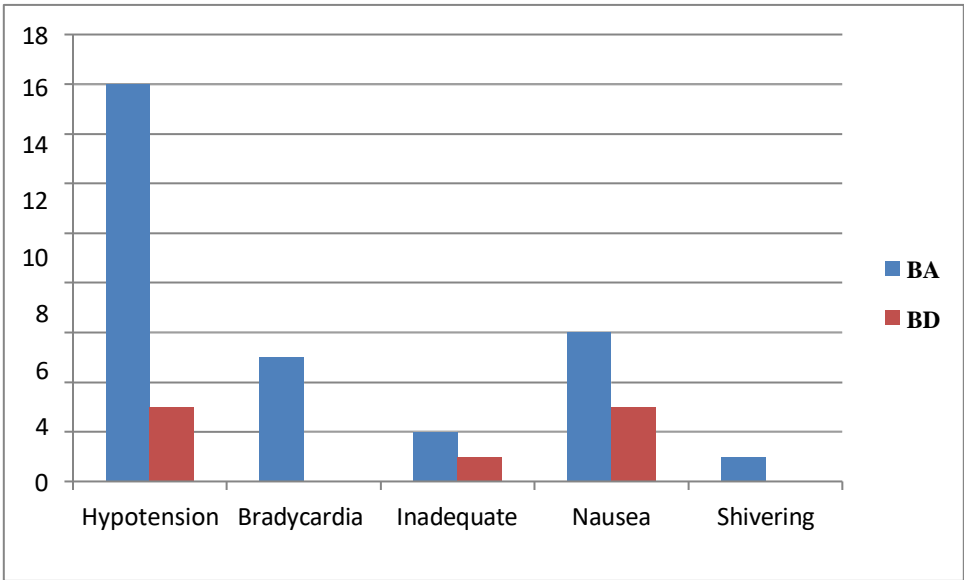


Figure 1: Incidence of Complications observed among the study groups

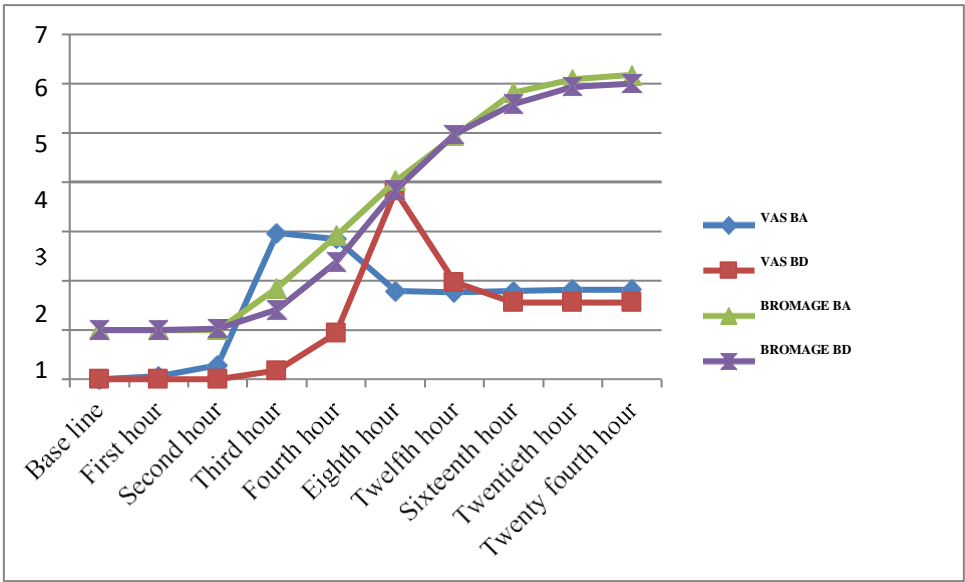


Figure 2: Bromage and vas scores among the study groups

DISCUSSION

Incidence of hypotension was observed in 16 (24.60%) and 03(4.61%) patients in groups BA and BD respectively, which showed a significant difference statistically, with $p=0.001$. Thus, the addition of 4 mg of dexamethasone to 0.5% heavy bupivacaine for unilateral spinal block reduced the incidence of hypotension compared to 0.5% heavy bupivacaine alone. This was a similar finding to the study of Takachenco et al,¹⁴ that found those who received 4 mg dexamethasone intrathecally with bupivacaine had reduced the hypotensive effect of spinal anaesthesia when compared with bupivacaine alone, $p=0.48$. Khaleel et al,¹⁵ also in a clinical trial study found out that when dexamethasone was mixed with heavy bupivacaine 0.5% it prevents hypotension which occurred in spinal anaesthesia compared with bupivacaine alone, with blood pressure 68.70 ± 6.46 and 85.44 ± 6.73 mmHg in control and dexamethasone groups respectively. In addition, a study by Ashoor et al,¹⁶ revealed that the addition of dexamethasone 8 mg intravenously 2 hours preoperatively decreased hypotension after spinal anaesthesia. Similarly, Esmat et al,¹⁷ in their results showed that the hypotensive effect of spinal anaesthesia was significantly reduced in patients that received 8 mg of dexamethasone intravenously 8 (8%) when compared with the control group 25 (25%, $p<0.00$). Incidence of bradycardia were 05 (7.70%) and 0 (0.00%) in groups BA and BD respectively with $p=0.003$, which was statistically significant. Thus intrathecal addition of dexamethasone significantly decreased incidence of post spinal bradycardia in unilateral spinal anaesthesia for ORIF. Nashwa et al,¹⁸ reported incidence of bradycardia following spinal anaesthesia in 2 (10%) patients in both dexamethasone and control, with $p=0.56$.

The patients that had nausea were 06 (09.20%) and 03 (4.60%) in groups BA and BD respectively in this study, with no significant difference, $p=0.26$. This may be connected with the use of unilateral spinal anaesthesia and a low dose of local anaesthetic agents in all the groups.¹⁹ Nashwa et al¹⁸ also reported that there was no statistically significant difference in the incidence of PONV during spinal anaesthesia for abdominal surgeries between dexamethasone group 1 (5%) patient and bupivacaine alone group 3 (15%) with $p=0.42$.

Similarly, El maurad et al²⁰ conducted a prospective randomized controlled study that evaluated the effect of the addition of 4 mg of dexamethasone as adjuncts to bupivacaine in TPVB and the results showed that the incidence of PONV in the study population was not statistically significant. In contrast, Ammar et al,²¹ found out that when dexamethasone was added to bupivacaine during transversus abdominis plane block for abdominal hysterectomy there was a reduced effect of PONV, 6 patients in the dexamethasone group and 14 patients in the control group, with $p=0.03$ which was statistically significant. Also, Deo et al²² in their study found that a single injection of dexamethasone, it has reduced the effect of nausea and vomiting in 14 patients in control and 2 patients in case groups which was statistically significant, $p<0.05$. Esmat et al,¹⁷ their results showed; 6 (6%) vs 27(27%) for nausea and 3(6%) vs (16%) for vomiting in dexamethasone and placebo with $p<0.001$.

Shivering was observed in one patient (1.50%) in group BA and none of the patients in BD, the $p=0.31$ which was statistically not significant. The reason may be due to the unilateral spinal technique given to all patients among the study groups. However, a study by Moeen et al²³ showed that intrathecal addition of dexamethasone was as effective in attenuation of shivering compared to bupivacaine alone in patients scheduled for prostate surgery under spinal anaesthesia. The number of patients with shivering was higher in bupivacaine alone group (13) than in dexamethasone group (2), with $p<0.01$ which was statistically significant.

None of the patients had failed block among the study groups. This may not be unconnected with the methodology used: patients were given the drugs in lateral decubitus, Whitacre spinal needle with the bevel directed distally, hyperbaric bupivacaine was used and patients were remained in that position for twenty minutes. These are the determinant factors for successful unilateral spinal block.²⁴ This was a similar finding with a study by Magar et al,²⁵ which reported that none of patients had failed block in unilateral spinal anaesthesia group, which may be due to the same reasons. Contrary to this findings, Kilinc²⁶ reported failure rate observed in the unilateral spinal anaesthesia group (5%) in their study, which may be as a result of the used of lower concentration of the drug: 0.5% hyperbaric

bupivacaine 7.5 mg and the lateral position was maintained for only 15 min before patients were turned to the supine position. Inadequate block was observed in 2(3.10%) patients in group BA compared to 1(1.50%) group BA with $p=0.15$ which showed no significant difference. This is in agreement with study by Colish et al,²⁷ which reported inadequate block rates of 3.9% and 3.8% among the study groups which were not statistically significant

CONCLUSION

The addition of 4 mg dexamethasone to 10 mg of 0.5% heavy bupivacaine was found to be associated with fewer incidences of complications compared with the use of 10 mg 0.5% heavy bupivacaine alone in unilateral spinal anaesthesia for unilateral lower limb ORIF in the immediate postoperative period.

Recommendation: based on the findings of the present study, the addition of 4 mg dexamethasone to 10 mg of 0.5% heavy bupivacaine in unilateral spinal anaesthesia should be encouraged in unilateral lower limb ORIF as it minimizes even the little complications that may arise

Limitations: sample size of 68 patients is relatively small compared to a larger population covering the whole of north-eastern Nigeria and as a Referral Centre; multicenter approach to get

a larger population for the study is needed to ensure the findings of the studied drug. Secondly, there was limited availability of studies on unilateral spinal anaesthesia with dexamethasone to compare with this work.

Declaration: this study has not been previously presented in a conference or published in another journal

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DETERMINANTS OF UNDERNUTRITION AMONG UNDER-FIVE CHILDREN IN RURAL COMMUNITY OF NORTHWESTERN NIGERIA

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ABSTRACT

Introduction: Nigeria has one of Africa's highest rates of undernutrition and the situation is particularly worst in northwestern Nigeria. This study aimed to determine the prevalence and determinants of undernutrition in Bagwai LGA, Kano, northwestern Nigeria. **Methodology:** This was a cross-sectional study of 358 children aged 6 - 59 months; a semi-structured questionnaire was used to collect data. Chi-square test was used to assess the association between the outcome and the respondent's characteristics while binary logistic regression model was employed to estimate the adjusted odds of malnutrition. **Results:** A total of 358 children were involved in this study with a mean age of 26.2(\pm 15) months. Up to 24.3% of the children were underweight and the prevalence of stunting was found to be 62% with 22.9% moderately stunted and 39.1% severely stunted; stunting was higher in males (66.3%) compared to females (56.9%). Underweight was also higher in males (28.0%) than females (20.0%). Wasting was also seen more in males (6.8%) compared to 2.4% in females. Underweight and stunting were mostly common within the age group 24-35months while wasting was found to be most prevalent in children aged 12-23 months. The odds of stunting was 5 times higher (OR=5.36, 95% CI=2.42 -11.89, $p<0.001$) in children aged 24-35 months and 3.5times higher (OR=3.55, 95% CI=6.83-7.47, $p<0.001$) in children aged 36-47months compared to children aged 6-11 months. The odd of stunting is almost 11 times higher in children whose mothers have no formal education (OR=10.92, 95% CI=3.37 - 35.36, $p<0.001$) compared to those who had tertiary education and the odds of stunting in male children is almost 2 times that of females (OR=1.72, 95% CI=1.12 - 2.64, $p=0.014$). **Conclusion:** These findings emphasize the multidimensional nature of undernutrition, involving both biological and socio-environmental determinants. Efforts to reduce stunting should prioritize improving access to female education, enhancing sanitation facilities, and addressing gender disparities in child health outcomes, as envisioned in global sustainable development goals. Furthermore, early interventions targeting older age groups and promoting proper nutrition and hygiene practices are essential to prevent stunting and its long-term impacts on child health and development.

Keywords: Determinants, undernutrition, stunting, wasting, underweight, children, Kano

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INTRODUCTION

The World Health Organization has classified malnutrition as the biggest threat to public health worldwide.¹ Malnutrition is a pathological state caused by a relative or absolute shortage or excess of one or more necessary nutrients/energy in a given individual or population.^{2,3} The term malnutrition addresses broad groups of conditions: undernutrition, which includes wasting (low weight-for-height), stunting (low height-for-age) and underweight (low weight-for-age); micronutrient-related malnutrition, which includes micronutrient deficiencies (a lack of important vitamins and minerals) or micronutrient excess; and overweight, obesity and diet-related noncommunicable diseases (such as heart disease, stroke, diabetes and some cancers).³ Globally, in 2022, 148 million children under 5 were estimated to be stunted (too short for age), 45 million were estimated to be wasted (too thin for height), and 37 million were overweight or living with obesity.³ Stunting is the devastating result of poor nutrition in-utero and early childhood. Children suffering from stunting may never attain their full potential and their brains may never develop to their full cognitive potential.⁴ These children begin their lives at a marked disadvantage with consequences continuing into adulthood: they face learning difficulties in school, earn less as adults, and face barriers to participation in their communities. Stunting has been declining steadily over the last decade, with 148.1 million, or 22.3 per cent of children under age 5 worldwide affected in 2022. Nearly all children affected lived in Asia (52 per cent of the global burden) and Africa (43 per cent of the global burden).⁴

Child wasting is the life-threatening result of poor nutrient intake and/or recurrent illnesses. Children suffering from wasting have weakened immunity, are susceptible to long-term developmental delays and face an increased risk of death, particularly when wasting is severe. Children suffering from severe wasting require early detection and timely treatment and care to survive. In 2022, an estimated 45 million children under 5 (6.8 per cent) were affected by wasting,

of which 13.7 million (2.1 per cent) were suffering from severe wasting.⁴ More than three quarters of all children with severe wasting live in Asia and another 22 per cent live in Africa.⁴

In recent times, sub-Saharan Africa (SSA) has had so much to grapple with in terms of the undernutrition. Within the SSA region, sub-regional variations in malnutrition are reported in the literature. According to Akombi *et al*, East and West Africa bear the greatest burden of malnutrition in the SSA region.⁵ The Nigerian Demographic and Health Survey (NDHS 2023) reported that 40% of children aged 6-59 months were stunted, 8% were wasted and 27% were underweight.⁶ These indices are even higher than that reported in the NDHS 2018, showing that the problem of undernourishment among under five-year children still remains a considerable challenge in Nigeria. The existing literature suggests malnutrition is still a big problem in Nigeria and needs further investigation.⁷⁻¹³ This study therefore set out to investigate the prevalence and determinants of malnutrition in rural community of Bagwai LGA in northwestern Nigeria. Further, previous research shows that maternal education,^{7,8} maternal nutrition⁹⁻¹², maternal low body mass index (BMI) (<18.5 kg/m²), maternal anemia (hemoglobin <12 g/dL)¹³ child's birth order and birth weight^{8,14}, maternal age, residence,¹⁵ antenatal care (ANC), child's sex,^{7,14} stool disposal system,¹² short period of breastfeeding¹⁶ and household income level¹⁷ are the main determinants of anthropometric failures (stunting, wasting, and underweight) among children.

All forms of malnutrition are preventable; to prevent malnutrition before it starts, children and their families need access to nutritious diets, essential services and positive practices to set them on the path to survive and thrive.⁴ Interventions to prevent malnutrition range from promoting breastfeeding to food supplementation schemes, whereas micronutrient deficiencies would best be addressed through food-based strategies. These strategies include dietary diversification through home gardens and small-scale livestock to minimize the burden on public

health.^{4,18} The Sustainable Development Goals (SDG) agenda represent a shared framework for promoting sustainable development through international collaboration. SDG 2 aims to end hunger, achieve food security and improved nutrition and promote sustainable agriculture.¹⁹ Even though there has been some progress towards the goal of ending all forms of malnutrition, with improvements in the global prevalence of stunting and wasting among children under five years of age, the world is not on track to achieving any of the seven global nutrition targets by 2030.²⁰ Nigeria ranks 160 out of 165 countries in terms of its progress towards achieving the SDGs while with regards to achieving SDG 2, Nigeria has progressed only minimally in lowering the prevalence of wasting and stunting among children under the age of five years.²⁰ Considering this background, it is evident that malnutrition remains a persisting problem in the country. This study therefore aims to assess the prevalence and determinants of undernutrition among under-five children in rural Bagwai, Kano, Nigeria.

METHODOLOGY

Study area and study design

The study area was Bagwai LGA Northwestern Nigeria while the study was a cross-sectional in design. Bagwai Local Government, named after Bagwai Town, is part of the Kano Emirate. Historically, Bagwai is bordered to the north by the Watari River (before 1976), to the southeast by the Yalawai River, and to the west by the Rafinkankanu Fadama, a tributary of the Watari River. The town is home to three major tribes: Hausawa, Fulani and the Kanuri.

Sample size determination

Using the formula for single proportion and prevalence of stunting of 40% (NDHS 2023), the minimum sample size of 369 was obtained.⁶

Sampling method

A cluster sampling method was used to select study subjects. Three political wards in Bagwai local government areas (LGAs) were selected and

all eligible children were studied until the required sample size was reached.

Study population

The inclusion criteria were children aged 6–59 months living with their parents in Bagwai LGA. Children with any known chronic debilitating illness that can affect growth such as sickle cell anemia, HIV infection, chronic kidney disease and congenital heart defects were excluded.

Data collection method

The data used for this study were collected using a semi-structured pre-tested questionnaire by trained enumerators which include nurses working in the rural community. Information was collected on children's, mother's, households and community-based characteristics.

Weight was measured in kilogram using a scale attached to a stadiometer to the nearest 0.1kg. Children who could not stand were held by the mother. Height was measured using the height meter attached to the stadiometer. For children under 24 months, recumbent length was measured in centimeters using a measuring tape while they were placed on a table.

Data management and analysis

Data collected was checked in the field for consistency and completeness. It was then coded and entered into a Microsoft Excel spreadsheet for cleaning and exported to SPSS version 25.0 for data analysis.²¹ Nutritional indices were assessed using the WHO ANTHRO software.²² Frequency and percentage were used to summarize categorical variables such as the nutritional status, age category and socio-economic status while means and standard deviations were used to summarize continuous variables such as weight for height and height for age z-scores. The associations between nutritional status and categorical variables (age category and socio-economic status) were determined using chi square. Determinants of childhood undernutrition were assessed using logistic regression analysis. All reported p-values <0.05 were considered statistically significant.

Ethical considerations

Ethical approval was obtained from the Health Research Ethics Committee of the Kano State Ministry of Health (Reference – SHREC/2023/5097). Informed consent was obtained from each caregiver; this was duly signed or thumb-printed by all respondents.

RESULTS

A total of 358 children (97% response rate) were involved in this study with a mean age of 26.2(\pm 15) months, they were mostly within the age range of 36-47(24.6%) and 24-35(23.2%); more than half were males (53.1%). The caregivers had a mean age of 30.5(\pm 7.5) years and were mostly (41.9%) within the age range of 20-39years. Most of the mothers had secondary level of education (53.6%) and they were mostly petty traders (78.2%). The fathers were mostly farmers (39.1%) followed by traders (36.3%) (Table 1).

Majority (84.1%) of the children were born at home. Almost all (99.2%) the children had been breastfed with a third (39.5%) still being breast fed. Two thirds of the children were first breast fed within the first hour of birth. More than half of the children had been given pre-lacteal feeds and majority (97.2%) had been given colostrum. Age at introduction of complementary feeds was at < 6 months for almost 87.4% of the children and majority (87.4%) of the children are breastfed for 18months and beyond. (Table 1) Almost 81% of the children had a BCG scar and 67.4% had been given vitamin A supplementation. They were mostly partially immunized, almost 53.4% of the children had fever, 38.3% had cough and almost 28.2% had diarrhea in the last 2 weeks preceding the interview.

Prevalence of undernutrition

This study showed that 24.3% were underweight with 17% moderately underweight and 7.3 % severely underweight. The prevalence of stunting was found to be 62% with 22.9% moderately stunted and 39.1% severely stunted. The study also showed that 4.8% of the children were wasted with 2.8% moderately wasted and 2.0%

severely wasted (Figure 1). Stunting was higher in males (66.3%) compared to females (56.9%). Underweight was also higher in males (28.0%) than females (20.0%) while wasting was also seen more in males (6.8%) compared to 2.4% in female.

Underweight was mostly common within the age group 24-35months with 27.7% and 10.8% moderately and severely underweight, respectively (Figure 3). Stunting was commonest within the age group 24-35month with 22.9 and 59% moderately and severely stunted, respectively. Wasting was also found to be most prevalent in children aged 12-23 months with 2.6% and 7.8% moderately and severely wasted, respectively.

Determinants of underweight

Bivariate analysis showed that mother's educational level ($p=0.016$), sex of the child ($p=0.025$), age of child 24-35month ($p<0.001$) and facility sanitation ($p=0.010$) were factors significantly associated with being underweight among children. Binary Logistic regression showed that the odds of underweight among children aged 24-35month was 4 times higher ($OR=4.39$, 95% CI = 1.68 - 11.50, $p=0.003$) compared to children aged 6-11months. Odds of underweight was almost 10 times higher ($OR = 10.045$, 95% CI = 1.26 - 79.95, $p=0.029$) in women with primary education compared to women with tertiary education (Table 2). Compared to the female child, the male child is almost two times ($OR:1.767$, CI:1.073,2.911, $p=0.025$) more likely to be underweight. Children living in households with unimproved sanitation are 2 times more likely to be underweight than those in houses with improved sanitation ($OR=2.30$, 95% CI=1.21 - 4.39, $p=0.063$). The odds of underweight amongst those that had diarrhea in the last 2 weeks and those that did not was almost the same ($OR=1.11$, 95% CI=0.66 - 1.89, $p=0.69$) (Table 2).

Determinants of stunting and wasting

Factors found to be associated with stunting included age of child ($p<0.001$), mothers' educational level ($p<0.001$) and sex of the child ($p=0.013$). The odds of stunting was 5 times

higher (OR = 5.36, 95% CI=2.42-11.89, $p<0.001$) in children aged 24-35month and 3.5times higher (OR=3.55, 95% CI= 6.83-7.47, $p=0.001$) in children aged 36-47month compared to children aged 6-11 months. The odd of stunting is almost 11 times higher in children whose mothers have no formal education (OR=10.92, 95% CI=3.37-5.36, $p<0.001$) compared to those who have

tertiary education. The odds of stunting in male children is almost 2 times that of females (OR=1.72, 95% CI=1.12-2.64, $p=0.014$) (Table 3). Wasting was found to be significantly associated with sex of the child; male children were 4 times more likely to be wasted than the female children (OR=4.23, 95% CI=1.19-14.96, $p=0.03$) (Table 4).

Table 1: Sociodemographic characteristics of children in Bagwai

| VARIABLE | FREQUENCY | PERCENTAGE |
|---|-----------|------------|
| Age of caregiver (years) | | |
| <20 | 8 | 2.2 |
| 20-29 | 150 | 41.9 |
| 30-39 | 134 | 37.4 |
| 40-49 | 66 | 18.4 |
| Age of children (months) | | |
| 6-11 | 48 | 13.4 |
| 12-23 | 78 | 21.8 |
| 24-35 | 83 | 23.2 |
| 36-47 | 88 | 24.6 |
| 48-59 | 61 | 17.0 |
| Sex of child | | |
| Male | 193 | 53.9 |
| Female | 165 | 46.1 |
| Educational level of caregiver | | |
| No formal education | 78 | 21.8 |
| Primary | 70 | 19.6 |
| Secondary | 192 | 53.6 |
| Tertiary | 18 | 5.0 |
| Occupation of caregiver | | |
| Farming | 22 | 6.1 |
| Seamstress | 45 | 12.6 |
| Petty trader | 280 | 78.2 |
| Civil servant | 11 | 3.1 |
| Occupation of father | | |
| Farming | 140 | 39.1 |
| Trader | 130 | 36.3 |
| Artisan | 18 | 5.0 |
| Civil servant | 70 | 19.6 |
| Place of birth | | |
| Home | 301 | 84.1 |
| PHC | 30 | 8.4 |
| General hospital | 24 | 6.7 |
| Private Hospital | 3 | 0.8 |
| Ever breastfed | | |
| Yes | 355 | 99.2 |
| No | 3 | 0.8 |
| Time of initiation of breast feeding | | |
| Within 1hr | 225 | 62.8 |
| Between 1hr and 24hrs | 197 | 30.1 |
| >24hrs | 25 | 6.0 |
| Colostrum given | | |
| Yes | 345 | 97.2 |
| No | 10 | 2.8 |
| Pre-lacteal feed | | |
| Yes | 196 | 55.2 |
| No | 159 | 44.8 |

| | | |
|--|-----|------|
| Age at introduction of complementary feeds | | |
| <6months | 313 | 87.4 |
| Six months & above | 45 | 12.6 |
| Currently breastfed | 140 | 39.4 |
| Breastfeeding child for 18months and beyond | 196 | 92.0 |
| Child still being breastfed | 153 | 39.5 |
| Facility sanitation | | |
| Unimproved | 267 | 74.6 |
| Improved | 91 | 25.4 |
| BCG scar | | |
| Yes | 289 | 80.7 |
| No | 16 | 4.5 |
| Immunisation status of children 1yr & above | | |
| Fully immunised | 6 | 2.1 |
| Partially immunised | 198 | 67.1 |
| Not immunised | 91 | 30.8 |
| Vitamin A supplementation | | |
| Yes | 211 | 67.4 |
| No | 102 | 32.6 |
| Fever in the last 2 weeks | | |
| Yes | 191 | 53.4 |
| No | 167 | 46.6 |
| Cough in the last 2 weeks | | |
| Yes | 137 | 38.3 |
| No | 221 | 61.7 |
| Diarrhoea in the last 2 weeks | | |
| Yes | 101 | 28.2 |
| No | 257 | 71.8 |

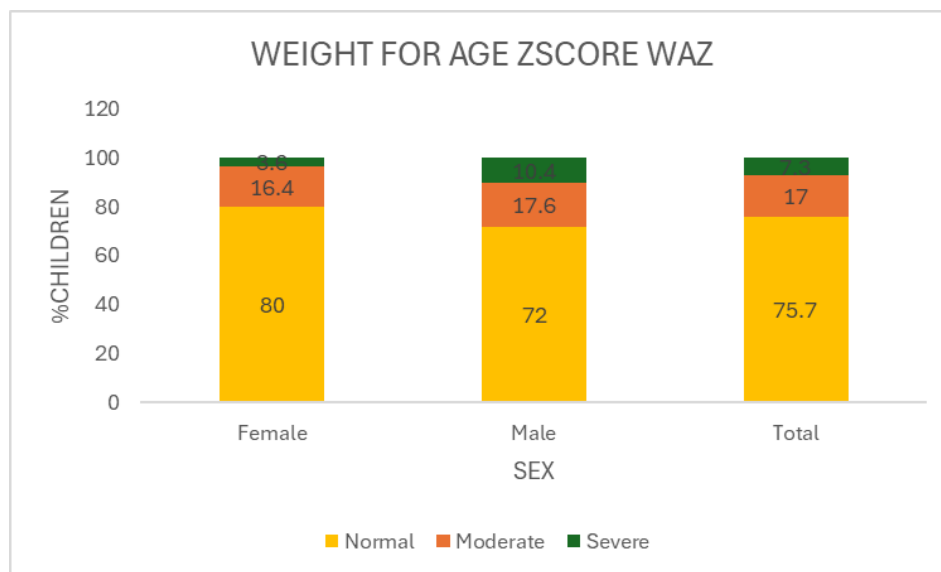
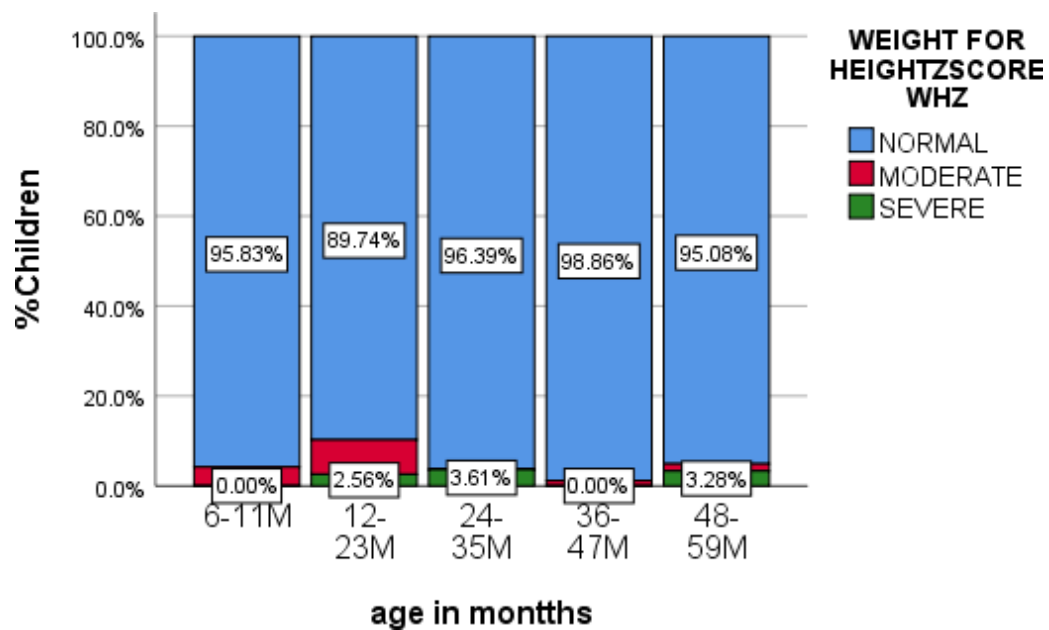
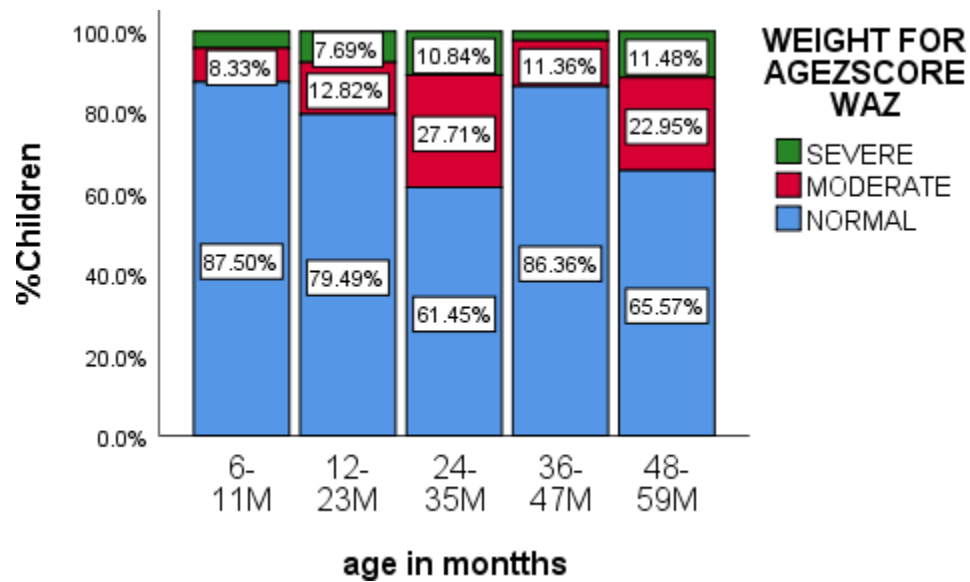




Figure 1: Nutritional status of children by sex



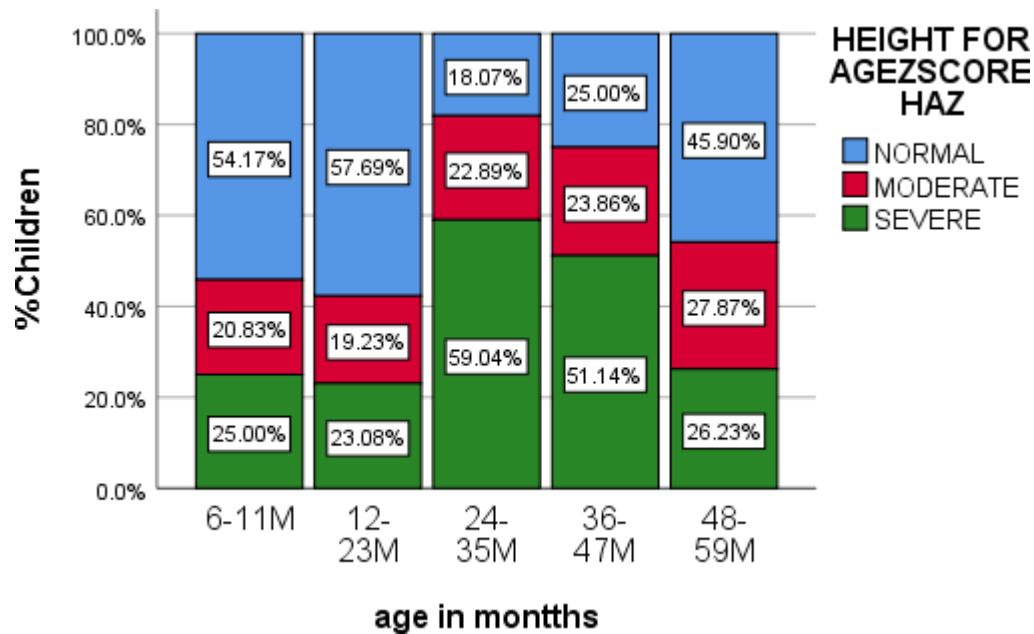


Figure 2: Nutritional status of children by age group

Table 2: Determinants of underweight among children in Bagwai

| Variable | Well nourished | Underweight | χ^2 test | Binary logistic model OR (95% CI) | |
|------------------------------------|----------------|-------------|---------------|-----------------------------------|-----------|
| | | | P - value | | P - value |
| Age of child (months) | | | 0.000 | | |
| 6-11 | 42(87.5) | 6(12.5) | | Reference | |
| 12-23 | 62(79.5) | 16(20.5) | | 1.806(0.654,4.993) | 0.254 |
| 24-35 | 51(61.4) | 32(38.6) | | 4.392(1.677,11.504) | 0.003 |
| 36-47 | 76(86.4) | 12(13.6) | | 1.105(0.387,3.158) | 0.852 |
| 48-59 | 40(65.6) | 21(34.4) | | 3.675(1.345,10.043) | 0.011 |
| Age of caregiver (years) | | | 0.380 | | |
| <20 | 7(87.5) | 1(12.5) | | | |
| 20-29 | 107(71.3) | 43(28.7) | | | |
| 30-39 | 103(76.9) | 31(23.1) | | | |
| 40-49 | 54(81.8) | 12(18.2) | | | |
| 2.945 | 0.400 | | | | |
| Sex of child | | | 0.025 | | |
| Female | 134(81.2) | 31(18.8) | | reference | |
| Male | 137(71.0) | 56(29.0) | | 1.767(1.073,2.911)) | 0.025 |
| Educational level of mother | | | 0.016 | | |
| No formal | 60(76.9) | 98(23.1) | | 5.100(0.04,1.004) | 0.126 |
| Primary | 48(62.9) | 26(37.1) | | 10.045(1.262,79.947) | 0.029 |
| Secondary | 150(78.1) | 42(21.9) | | 4.760(0.615,36.813) | 0.135 |
| Tertiary | 17(94.4) | 1(5.6) | | REFERENCE | |
| Occupation of caregiver | | | | | |
| Farming | 18(81.8) | 4(18.2) | 0.206 | | |
| Artisan | 31(68.9) | 14(31.1) | | | |
| Petty traders | 216(77.1) | 64(22.9) | | | |
| Civil servant | 6(54.5) | 5(45.5) | | | |
| Fathers' occupation | | | 0.099 | | |
| Farming | 112(80) | 28(20.0) | | | |
| Artisan | 101(77.7) | 29(22.3) | | | |
| Petty traders | 12(66.7) | 6(33.3) | | | |
| Civil servant | 46(65.7) | 24(34.3) | | | |

| | | | | | |
|--|-----------|----------|-------|--------------------|-------|
| Colostrum | | | 0.287 | | |
| Yes | 260(75.4) | 85(24.6) | | | |
| No | 9(90.0) | 1(10.0) | | | |
| Pre-lacteal feed | | | 0.897 | | |
| Yes | 148(75.5) | 48(24.5) | | | |
| No | 121(76.1) | 38(23.9) | | | |
| Age at introduction of complementary feed | | | 0.275 | | |
| <6months | 234(74.8) | 79(25.2) | | | |
| 6months and above | 37(82.2) | 8(17.8) | | | |
| Immunization status | | | 0.448 | | |
| Fully immunized | 7(77.8) | 2(22.2) | | | |
| Partially immunized | 181(77.7) | 52(22.3) | | | |
| Not immunized | 83(71.6) | 33(28.4) | | | |
| Vitamin A | | | 0.111 | | |
| Yes | 152(72.6) | 59(28.0) | | | |
| No | 82(80.4) | 20(19.6) | | | |
| Cough in the last 2 weeks | | | 0.665 | | |
| Yes | 102(74.5) | 35(25.5) | | | |
| No | 169(76.5) | 52(23.5) | | | |
| Diarrhea in the last 2 weeks | | | 0.021 | | |
| Yes | 68(67.3) | 33(32.7) | | 1.114(0.655,1.894) | 0.690 |
| No | 203(79.0) | 54(21.0) | | REFERENCE | |
| Fever in the last 2 weeks | | | 0.168 | | |
| Yes | 139(72.8) | 52(27.2) | | | |
| No | 132(79.0) | 35(21.0) | | | |
| Sanitation facility | | | 0.010 | | |
| Unimproved | 193(72.3) | 74(27.7) | | REFERENCE | |
| Improved | 78(85.7) | 13(14.3) | | 2.301(1,206,4.387) | 0.011 |

Table 3: Determinants of stunting among children in Bagwai

| Variable | Well nourished | Stunting | χ^2 test | Binary logistic model | |
|------------------------------------|----------------|-----------|---------------|-----------------------|---------|
| | | | P-value | OR (95% CI) | P-value |
| Age of child (months) | | | 0.000 | | |
| 6-11 | 26(54.2) | 22(45.8) | | REFERENCE | |
| 12-23 | 45(57.7) | 33(42.3) | | 0.867(0.420,1.788) | 0.698 |
| 24-35 | 15(18.1) | 68(81.9) | | 5.358(2.415,11.886) | <0.001 |
| 36-47 | 22(25) | 66(75.0) | | 3.545(1.683,7.469) | 0.001 |
| 48-59 | 28(45.9) | 33(54.1) | | 1.393(0.652,2.975) | 0.392 |
| Age of caregiver (years) | | | 0.541 | | |
| <20 | 5(62.5) | 3(37.5) | | | |
| 20-29 | 57(38.0) | 93(62.0) | | | |
| 30-39 | 49(36.6) | 85(63.4) | | | |
| 40-49 | 25(37.9) | 41(62.1) | | | |
| 2.139 | 0.544 | | | | |
| Sex of child | | | 0.013 | | |
| Female | 74(44.8) | 91(55.2) | | REFERENCE | |
| Male | 62(32.1) | 131(67.9) | | 1.718(1,117,2.643) | 0.014 |
| Educational level of mother | | | | | |
| No formal | 15(19.2) | 63(80.8) | | 10.920(3.372,35.364) | <0.001 |
| Primary | 16(22.9) | 54(77.1) | | 8.775(2.716,28.347) | <0.001 |
| Secondary | 92(47.9) | 100(52.1) | | 2.826(0.970,8.235) | 0.057 |
| Tertiary | 13(72.2) | 5(27.8) | | REFERENCE | |
| Mothers' occupation | | | 0.397 | | |
| Farming | 8(36.4) | 14(63.6) | | | |
| Artisan | 12(26.7) | 33 (73.3) | | | |
| Petty traders | 112(40.0) | 168(60.0) | | | |
| Civil servant | 4(36.4) | 7(63.6) | | | |
| Fathers occupation | | | 0.232 | | |
| Farming | 50(35.7) | 90(64.3) | | | |
| Artisan | 7(38.9) | 11(61.1) | | | |
| Petty traders | 57((43.8) | 73(56.2) | | | |

| | | | | | |
|--|-----------|-----------|-------|--|-------|
| Civil servant | 22(31.4) | 48(68.6) | | | |
| Colostrum | | | 0.596 | | |
| Yes | 132(38.3) | 213(61.7) | | | |
| No | 3(30.0) | 7(70.0) | | | |
| Pre-lacteal feed | | | 0.437 | | |
| Yes | 71(36.3) | 125(63.8) | | | |
| No | 64(40.3) | 95(59.7) | | | |
| Age at introduction of complementary feed | | | 0.918 | | |
| <6months | 298(95.2) | 15(4.8) | | | |
| 6months and above | 43(95.6) | 2(4.4) | | | |
| Immunization status | | | 0.456 | | |
| Fully immunized | 3(33.3) | 6(66.7) | | | |
| Partially immunized | 94(40.3) | 139(59.7) | | | |
| Not immunized | 39(33.6) | 77(66.4) | | | |
| Vitamin A | | | 0.700 | | |
| Yes | 78(37.4) | 133(63.0) | | | |
| No | 40(39.2) | 62(60.8) | | | |
| Cough in the last 2 weeks | | | 0.119 | | |
| Yes | 59(43.1) | 78(56.9) | | | |
| No | 77(34.8) | 144(65.2) | | | 0.078 |
| Diarrhea in the last 2 weeks | | | 0.224 | | |
| Yes | 27(26.7) | 74(73.3) | | | |
| No | 109(42.4) | 148(57.6) | | | |
| Fever in the last 2 weeks | | | 0.320 | | |
| Yes | 68(35.6) | 123(64.4) | | | |
| No | 68(40.7) | 99(59.3) | | | |
| Sanitation facility | | | 0.670 | | |
| Unimproved | 105(38.6) | 167(61.4) | | | |
| Improved | 31(36.0) | 55(64.0) | | | |

Table 4: Determinants of wasting among children in Bagwai

| Variable | Well nourished | Wasting | χ^2 test P- value | Binary logistic model OR (95% CI) | P-value |
|------------------------------------|----------------|---------|---------------------------|--------------------------------------|---------|
| Age of child (months) | | | 0.090 | | |
| 6-11 | 46(95.8) | 2(4.2) | | | |
| 12-23 | 70(89.7) | 8(10.3) | | | |
| 24-35 | 80(96.4) | 3(3.6) | | | |
| 36-47 | 87(98.9) | 1(1.1) | | | |
| 48-59 | 58(95.1) | 3(4.9) | | | |
| Age of caregiver (years) | | | 0.799 | | |
| <20 | 8(100) | 0(0) | | | |
| 20-29 | 142(94.7) | 8(5.3) | | | |
| 30-39 | 127(94.8) | 7(5.2) | | | |
| 40-49 | 64(97.0) | 2(3.0) | | | |
| Sex of child | | | 0.016 | 4.223(1.192,14.963) | 0.026 |
| Female | 162(98.2) | 3(1.8) | | | |
| Male | 179(92.7) | 14(7.3) | | | |
| Educational level of mother | | | 0.953 | | |
| No formal | 74(94.9) | 4(5.1) | | | |
| Primary | 66(94.3) | 4(5.7) | | | |
| Secondary | 184(95.8) | 8(4.2) | | | |
| Tertiary | 17(94.4) | 1(5.6) | | | |
| Mothers' occupation | | | | | |
| Farming | 21(95.5) | 1(4.5) | 0.811 | | |
| Artisan | 42(93.3) | 3(6.7) | | | |
| Petty traders | 268(95.7) | 12(4.3) | | | |
| Civil servant | 10(90.9) | 1(9.1) | | | |
| Fathers Occupation | | | 0.442 | | |
| Farming | 132(94.3) | 8(5.7) | | | |
| Artisan | 125(96.2) | 5(3.8) | | | |
| Petty traders | 16(88.9) | 2(11.1) | | | |
| Civil servant | 68(97.1) | 2(2.9) | | | |

| | | | | | |
|--|-----------|---------|-------|--|--|
| Colostrum | | | 0.472 | | |
| Yes | 328(95.1) | 17(4.9) | | | |
| No | 10(100) | 0(0.0) | | | |
| Pre-lacteal feed | | | | | |
| Yes | 202(95.3) | 10(4.7) | 0.183 | | |
| No | 161(92) | 14(8) | | | |
| Age at introduction of complementary feed | | | 0.918 | | |
| <6months | 298(95.2) | 15(4.8) | | | |
| 6months and above | 43(95.6) | 2(4.4) | | | |
| Immunization status | | | | | |
| Fully immunized | 9(100) | 0(0) | 0.540 | | |
| Partially immunized | 237(94.4) | 14(5.6) | | | |
| Not immunized | 121(92.4) | 10(7.6) | | | |
| Vitamin A | | | 0.286 | | |
| Yes | 199(94.3) | 12(5.7) | | | |
| No | 99(97.1) | 3(2.9) | | | |
| Cough in the last 2 weeks | | | | | |
| Yes | 130(94.9) | 7(5.1) | 0.800 | | |
| No | 211(95.7) | 10(4.5) | | | |
| Diarrhea in the last 2 weeks | | | 0.506 | | |
| Yes | 95(94.1) | 6(5.9) | | | |
| No | 246(95.7) | 11(4.3) | | | |
| Fever in the last 2 weeks | | | 0.972 | | |
| Yes | 182(95.3) | 9(4.7) | | | |
| No | 159(95.2) | 8(4.8) | | | |
| Sanitation facility | | | 0.961 | | |
| Unimproved | 259(95.2) | 13(4.8) | | | |
| Improved | 82(95.3) | 4(4.7) | | | |

DISCUSSION

The study assessed the prevalence and determinants of undernutrition in children under the age of five years in Bagwai community. It showed the prevalence of underweight was 24.5%, stunting 62% and wasting 4.8%. The proportion of children who are stunted is much higher than the 37% national average reported by the Nigerian Demographic and Health survey (2023), with the prevalence reaching 53.2% in the northwest region.⁶ The figures for underweight and wasting are slightly higher than the national figures of 27% and 7% respectively. A systematic review to determine the prevalence and determinants of malnutrition in Nigeria revealed that the highest prevalence of underweight, wasting and stunting were 43.3%, 29.3% and 41%, respectively.²³ While another review that explored the disparities of malnutrition in Nigeria and potential problems revealed that stunting remained alarmingly high ranging from 7.2% (Osun, Southwest) to 61% (Kaduna, North Central), while wasting varied from 1% (Ibadan, Southwest) to 29% (FCT Abuja, Central) and underweight from 5.9% (Osun, Southwest) to

42.6% (Kano, Northwest) respectively.²⁴ A study in Ghana to determine the contributing factors of malnutrition also showed that 35.9% of children under 5 years were underweight, 13.9% stunted and 33.9% wasted, indicating that the prevalence of stunting in this study is alarmingly high, and wasting is the least prevalent indicator in all the studies.¹⁸ Similar to this study, a study in rural farmland in Ogun state found a prevalence of stunting, underweight and wasting of 70%, 24%, and 8%, respectively.²⁵ Another study in Kebbi also showed that stunting was high (60%) indicating that childhood stunting is a key issue in northern Nigeria that warrant special public health and community-wide attention.²⁶ Children affected by stunting can suffer severe irreversible physical and cognitive damage that accompanies stunted growth. The devastating consequences of stunting can last a lifetime and even affect the next generation.⁴

Undernutrition prevalence also varies with children's age, the current study shows that both stunting and underweight were mostly common within the age group 24-35months while wasting was found to be most prevalent in children aged

12-23 months. Similar to our findings, Obasohan *et al*²⁷ also observed that the odds of children aged 24–35 months developing malnutrition were two times the odds of children 6–11 months of age. Similarly, Amoah *et al*¹⁸ also observed that the likelihood of being underweight among children aged 24-35 months was nearly two times higher than children under 24 months. Similar conclusions were reached in previous studies that reported an increase in the age of the children has a harmful effect on poor nourishment for the children.²⁸⁻⁴⁰ The possible explanation for this difference is that as the child grows older, less attention is paid to their nutritional requirement and overall welfare compared with the youngest child.

Stunting and underweight were commoner in males compared to females; wasting was also commoner in males compared to males. This is similar to other studies where malnutrition was commoner in the male children than females.^{27,41} The current study found that compared to the female child, the male child is almost two times more likely to be underweight and also the odds of stunting in male children is almost two times that of females. In the fixed effect analysis, the study found that female children have considerably decreased odds of being poorly nourished than their male counterparts.²⁷ The same findings were reported in previous studies on malnutrition.^{26,27,42-54} Contrary to these findings, Amoah *et al*¹⁸ observed that the female child was 8 times more likely to be underweight compared to their male counterpart and was consistent with other findings.⁵²

A high level of education of mothers also guarantees better female independence and in turn affects decisions that border on health, and consequently improvement of child nutritional status.⁵ Mothers with high level of education tends to utilize health care facilities better with the high implementation of improved medical practices. The current survey revealed that the odds of underweight was almost 10 times higher in women with primary education compared to women with tertiary education. This position is consistent with other studies who posited that child malnutrition and mother's education are indirectly correlated as well as studies that

substantiated the result on maternal education.^{7,42,52,54}

Several studies have shown an independent association between the incidence of common illnesses such as diarrhea, cough and cold and the development of malnutrition. Acute infections can lead to weight loss and being underweight can suppress immunity, increasing the risk of infections resulting in a vicious cycle of disease and poor nutrition.^{47,55-61} However, this study showed that odds of underweight amongst those that had diarrhea in the last 2 weeks and those that did not was almost the same. This is contrary to other studies that found children who had diarrhea two weeks before the survey were more likely to be poorly nourished than children who did not have the illnesses.^{27,29,30}

The current survey showed that children living in households with unimproved sanitation are two times more likely to be underweight than those in households with improved sanitation. This finding is consistent with a case-control study in Pakistan, which showed significant association between pour/pit/open sewer and malnutrition.⁶¹ Children with access to ventilated improved pit latrines (VIPs) or flush toilets had a decreased risk of malnutrition. Unhygienic conditions such as open defecation and pour or pit latrine are associated with malnutrition according to many studies conducted in rural settings.⁶²

This study highlights the critical factors contributing to the high prevalence of malnutrition, particularly stunting, in Northern Nigeria. Male children, older age groups (24-35 months), low maternal education and poor sanitation facilities were identified as significant predictors of stunting. Comprehensive community-based strategies integrating these factors will be critical in combatting the high rates of stunting and fostering healthier, more resilient children. However, this study is limited by its cross-sectional design. There is potential for recall bias in the self-reported data, as well as the possibility of measurement errors.

CONCLUSION

These findings emphasize the multidimensional nature of undernutrition, involving both

biological and socio-environmental determinants. Efforts to reduce stunting should prioritize improving access to female education, enhancing sanitation facilities, and addressing gender disparities in child health outcomes, as envisioned in global sustainable development goals. Furthermore, early interventions targeting older age groups and promoting proper nutrition and hygiene practices are essential to prevent stunting and its long-term impacts on child health and development.

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INFLUENCE OF HEALTH EDUCATION INTERVENTION ON WILLINGNESS TO ACCEPT HUMAN PAPILLOMA VIRUS VACCINATION AMONG PARENTS OF ADOLESCENTS IN KANO METROPOLIS, NIGERIA: A QUALITATIVE STUDY

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ABSTRACT

Background: Human papillomavirus (HPV) causes sexually transmitted infection that affects approximately 90% of people during their reproductive lifetime. It can cause several types of cancers such as anal and penile cancer, cancer in the head and neck area as well as cervical cancer but there are still gaps in the knowledge of HPV and willingness to accept the vaccine. **Objectives:** To determine the impact of health education intervention on knowledge of and willingness to accept HPV vaccination among parents of adolescent in Kano Metropolis, Nigeria. **Methodology:** A quasi-experimental design with pre and post-intervention data collection using qualitative method was conducted among sixteen (16) purposely selected participants from Tarauni the intervention and Gwale the control LGAs, respectively, Data for this study were collected through focus group discussions and the data was analysed using thematic analysis. **Result:** The participants had poor knowledge of HPV and were unwilling to accept the vaccine for their adolescents' because they were afraid of side effects, complained about cost of vaccine and had misconceptions in both groups before the intervention but there were marked variations of responses in the intervention group after the intervention. **Conclusion:** The health education intervention showed an influence on parental knowledge of HPV and willingness to accept HPV vaccine in the intervention group. Hence there is need to sustained it which eventually will reduce the infection and its consequences.

Keywords: HPV, vaccine, knowledge, willingness, health education, Kano

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INTRODUCTION

Human Papilloma Virus (HPV) is a sexually transmittable infection that infects approximately 70% of people during their lifetime.¹ It can cause several types of cancers such as anal and penile cancer, cancer in the head and neck area as well as cervical cancer; the latter being the most frequently occurring HPV-related cancer.¹ Globally the commonest oncogenic serotypes of HPV are 16 and 18, while others serotypes such as 31, 33, 35, 45, 52, 57, 58, 66, 67, 69, 70, 73 and 82 have also been implicated.²

A quadrivalent vaccine was approved by the Food and Drug Administration (FDA) in 2006 for the prevention of cervical cancer, certain precancerous lesions, and genital warts in females and in 2009, for the prevention of genital warts in males. Also, a bivalent vaccine was also approved by the FDA in October 2009 for the prevention of cervical cancer and certain precancerous lesions caused by HPV infection.³

Two HPV vaccines are available worldwide: a bivalent vaccine, against HPV types 16 and 18 (these two types cause 70% of cervical cancers in most part of the world) and a quadrivalent vaccine, against HPV 16 and 18 as well as HPV 6 and 11 (6 and 11 are responsible for benign anogenital warts and recurrent respiratory papillomatosis), a disease where recurrent growths occur in the airways, frequently on the vocal cords. Neither vaccine contains a live virus therefore they don't act by causing an infection. Both vaccines are prophylactic and are most effective when administered prior to infection with HPV, which is acquired by most individuals shortly after sexual debut. The vaccines are not therapeutic, nor do they have any effect on progression to disease in persons who have HPV infection at the time of vaccination.⁴

HPV vaccines offer the best protection to women and men who receive all three doses in the

appropriate sequence and have time to develop an immune response before becoming sexually active. Initiation of HPV vaccination is recommended for girls and boys beginning when they are aged 9 to 13 years.⁵ A recent review by the Centres for Disease Control and prevention (CDC) it recommended that 11 to 12 year old to receive two doses of HPV vaccine at least six months apart rather than the previously recommended three doses to protect against cancers caused by HPV infections. Teens and young adults who start the series of HPV vaccines later, at ages 15 through 26 years will still need three doses of HPV vaccine to protect against cancer-causing HPV infection. Two doses of HPV vaccine given at least six months apart at ages 11 and 12 years will provide safe, effective, and long-lasting protection against HPV related cancers.⁶

HPV vaccine was licensed in Nigeria since April 2009, The vaccine is available at some private and public hospitals in Nigeria at a cost ranging between nine thousand naira to fifteen thousand naira (₦9,000:00 - ₦15,000:00) per dose, however, very few have been immunised against HPV since its introduction but National Primary Health Care Development Agency is working hard to introduce it into the routine national immunization schedule by 2020 after demonstration project in the country.⁸

Public HPV vaccine and cervical cancer education can take place at schools, workplaces, churches, mosques, traditional leaders' palace, market places and durbars for good coverage to be achieved as indicated that majority of the women preferred educational programmes at such venues.⁹ The global prevalence of HPV infection is about 11-12%. The five most prevalent HPV types worldwide were HPV16 (3.2%), HPV18 (1.4%), HPV52 (0.9%), HPV31 (0.8%) and HPV58 (0.7%), There is considerable regional variation in global HPV prevalence with the highest figures in sub-Saharan Africa (24%),

Eastern Europe (21%) and Latin America (16%). Particularly high prevalence is seen in Eastern Africa and the Caribbean, where rates exceed 30% and Nigeria has reported overall HPV prevalence of 26.3%.¹⁰

Cervical cancer ranks as the second most frequent cancer among women in Nigeria, with about 47 million women aged 15 years and older being reported to be at risk of developing cervical cancer, almost 14,089 Nigerian women are diagnosed with cervical cancer and 8240 die from the disease yearly.⁷ About 23.7% of women and 73% of men in the general population in Nigeria carry HPV genital infection which can lead to different malignant lesion.¹¹ Despite the efficacy that has been observed with the prophylactic HPV vaccines, the uptake is sub-optimal in Nigeria due to several reasons including availability and very low level of awareness even among health professionals. Other reason includes high cost, weak health system and cultural belief.¹⁰

Health education and effective communication are potentially crucial in achieving successful immunization programs especially with the current global shift from curative medicine to preventive medicine, more effort is required in improving parents' knowledge about HPV infection and vaccine which may improve their willingness to uptake the vaccine.

METHODOLOGY

Study area

Kano metropolis is a centre of commerce, and the economic nerve centre of the north located in Kano State North-western geo-political zone of the country and the most populous state in Nigeria. Hausa/Fulani predominantly occupied the place followed by Igbo, Yoruba, Kanuri, Egbira, Igala and other many other tribes but Islam is the predominant religion then Christians and followers of other religions.¹²

The State has 44 Local Government Areas with a population of 9,383,682 million people, 4,844,128 (51%) males and 4,539,554 (49%) females, according to the 2006 census by the National Population Commission,¹² with majority of the populace living in the metropolitan

LGAs.¹³ However, Kano State has 16.5% vaccination coverage for routine immunization,¹² with the population of adolescents as 19.4% male and 18.8% female.¹⁴

Study sites

The study was carried out in Kano metropolis. The metropolis is made of eight Local Government Areas (LGAs) consisting of Kano municipal, Dala, Fagge, Gwale, Kumbotso Nassarawa, Tarauni, and Ungoggo LGAs.¹⁴ Tarauni and Gwale were purposively selected as intervention and control LGA respectively, Tarauni and Gwale has a distance of about 15km apart.

Study design

A community based qualitative design with pre and post-intervention data collection was used.

Study population

Parents of adolescent residing in the intervention and control LGAs for at least six months were included while parents who have already vaccinated their adolescent and those that were not around during the study were excluded

Sample size

Sixteen (16) participants were used as the sample size for this qualitative study, eight in Tarauni the intervention and eight in Gwale the control LGAs, four FGDs were conducted pre and post intervention in each LGAs respectively.

Sampling technique

The participants were purposively selected according to their ages, educational qualification and sex to ensure homogeneity in each community.

Study Instruments

Focus group discussions (FGD) was used in collecting qualitative data using the FGD guide adapted from a previous study.¹⁵ The FGD guide was translated to Hausa because it was used in that language and back translated to English.

Data collection methods

The FGD guide adapted from a previous study.¹⁵ was used to collect data from the respondents pre-intervention by conducting four interviews and six months post intervention by conducting another four interviews in both intervention and control LGAs after pretesting the FGD guide. Four research assistants were recruited and trained for this study (2 males and 2 females). They were trained for four days which covered the objectives of the study.

Health education intervention were carried out in batches in the intervention community only and same health education was given to the control community after data collection so that they would also benefit from the information given to the intervention community. Methods employed in the health education include lectures (power point presentation on topics that covered HPV infection and HPV vaccine, diseases associated with HPV infection, vaccine recommendations, dosage schedule, vaccine efficacy, safety, myths and misconceptions). Pamphlets were distributed to the participants and monthly SMS reminder was sent on the content of health education and free medical check-up including checking of blood pressure, weighing and sugar level was done for each participant free of charge.

Data Management

Tape recordings from the FGDs of both groups in each component of the study (pre- and post-intervention) were transcribed verbatim including pauses and interruptions, then put together with the field notes and analysed. Transcribed material was including gestures and other non-verbal responses. Information obtained from the FGDs were transcribed verbatim and translated into English. The transcripts were coded and analysed using thematic analysis.

Ethical Considerations

Ethical approval for the study was obtained from Aminu Kano Teaching Hospital and Kano State Health Research-Ethics Committee (NHREC/21/08/2008/AKTH/EC/2564 and MOH/off/797/T.I/1741). The Helsinki declaration was respected throughout the research.¹⁶

FOCUS GROUP DISCUSSION FINDINGS

Comparison between Pre-and Post-Intervention Focus Group Discussions in the intervention group

The major themes that emerged from the FGD were:

1. Respondents' Knowledge of Sexually transmitted Infections

Before the intervention, knowledge of the common sexually transmitted diseases, among majority of the participants was scanty. A few of them mentioned some; *"I know of few of the sexual transmitted diseases like HIV and gonorrhoea"* (FGD, Female civil servants, trader and artisan. Tarauni, Kano.). However, post-intervention, majority were able to list most of the diseases *"...now we know other forms of sexually transmitted diseases like PID, syphilis and vaginal candidiasis"*

Another discussant added *"I know of gonorrhoea and HIV"* (FGD, Male trader, artisan and civil servant Tarauni, Kano) but after the intervention *"I know HIV, syphilis, gonorrhoea, PID and vaginal candidiasis"* were added.

2. Respondents' Knowledge of Genital malignancies

Regarding genital malignancies, most of the participants expressed complete lack of awareness *"we are not aware but we know breast cancer that affects women"* (FGD, Female civil servants, artisan and farmer Tarauni, Kano). Post-intervention, majority of the discussants could name several forms of genital malignancies like *"cervical cancer, penile cancer and vulval cancer"*. However, other participants said that *"We know prostate cancer"* (FGD, Male trader, civil servants and farmer Tarauni, Kano). But after the intervention *"cervical cancer, penile cancer and other genital lesion"* were added and the participants laughed *"thank God for your coming now we have an insight about sexually transmitted diseases"*

3. Respondents' Knowledge of HPV Infection

Participants were asked what they knew about HPV Infection, their responses demonstrate lack of knowledge about the infection

"We are not aware of HPV infection but we thought majority of the people with infection in their private part are infected through the use of unhygienic toilet" (FGD, Female trader, farmer and artisan Tarauni, Kano.) another woman said *"Gonorrhoea if become chronic will transform to HPV infection"* (FGD, Female trader Tarauni, Kano.). At post- intervention, the participants were able to know *"HPV infection which cause genital wart, cervical cancer, penile cancer and cancer in the respiratory tract"* similarly they know *" how is the person get and transmit the infection"* Another participant said *"I know about HPV infection when i attended one adolescents health programme and it is very common but because the disease it goes unnoticed that's why many peoples didn't bother about it"* (FGD, Male civil servant Tarauni, Kano.) but now after the intervention *"I understand that HPV infection can lead to different lesion in the private part and other part of the body"*

4. Respondents' Knowledge of HPV Vaccine

Participants were asked what they knew about HPV vaccine, most of the participants they know nothing about the vaccine as they mentioned *"We don't know anything about HPV vaccine"* (FGD, Female trader, civil servants and artisan Tarauni, Kano.) but one of the participant said that *"I heard about HPV vaccine in the radio"* (FGD, Female civil servants Tarauni, Kano.). At post-intervention, the participants appreciate what HPV vaccine is all about *"HPV vaccine is given to both adolescents boys and girls in order to prevent them from HPV infection which subsequently lead to different forms of genital lesion"* However, some of the participants mentioned that *"three doses of HPV vaccine can be given to adolescents preferably before sexual exposure"*

Other participants said that *"We don't know about HPV vaccine"* (FGD, Male Artisan, trader and farmer Tarauni, Kano.) then one of the participant said that *"I know about HPV vaccine when i attended one adolescents health programme and is given to adolescent girl but I don't know how, where is being giving"* (FGD, Male civil servant Tarauni, Kano.) After the intervention *"I knew that HPV vaccine can also be given to adolescent boys, three doses for both sex which can prevent*

HPV infection that cause genital lesion for both sex, penile cancer for male and cervical cancer for female" also other participants happily said that *"now we are aware of HPV vaccine, it uses, the group of peoples that are supposed to be giving and the number of doses"*

5. Assuming there is Vaccine to protect HPV infection how can it help

Most of the participants mentioned that since we are not aware of HPV vaccine, how can we know it uses *"we don't know about it talk less of it uses"* (FGD, Female trader, artisan and farmer Tarauni, Kano). At post- intervention the participant were delighted *"yes it will really help in curtailing the spread of the infection especially among adolescents"* some participants mentioned that *"if HPV vaccine is available it will definitely help in reducing the rate of HPV infection and development of cervical and penile cancers"*

Interestingly one of the participant said *"though no any vaccine can give 100% protection but am sure HPV vaccine can help in reducing the chances of contracting HPV infection"* (FGD, Male civil servants Tarauni Kano).

6. What concern do you have about the vaccine

Participants were asked if they have concern over HPV Vaccine of course vehemently they mentioned *"We are doubting about the vaccine, it side effect in feature"* while other mentioned *"Our concern is cost of the vaccine and fear of our children they may engage in pre-marital sexual activities thinking that the vaccine is going to protect them from contracting STDs"* and some said *"If the vaccine has any side effects after use who will be held responsible"* (FGD, Female farmer, trader, civil servants and artisan Tarauni, Kano.) after the intervention participants understand that the side effect of the vaccine is not as they think from the beginning *" we will use the vaccine for our adolescents boys and girls since you explain to us about the efficacy and less site effect"* then other participants cheerfully said that *"now we know that HPV vaccine is available and if adolescents use it is going to be beneficial to them"*

Participants also mentioned *"Cost of the vaccine is our concern considering the economic*

situation of the country then some vaccines are wisely used for family planning” (FGD, Male farmer, civil servants and artisan Tarauni, Kano) at post- intervention participants joyfully said that “you clear the air about the vaccine concerning its importance, efficacy and availability but we want government to make it a routine immunization” other participant said “yes now we don’t have much concern about side effect, efficacy, disguising as family planning methods but many peoples cannot afford the vaccine since the infection is going unnoticed”

7. Decision for the uptake of HPV Vaccine and the preferred place for immunization

Participants were asked who decided for children to uptake the vaccine and the preferred place for immunization their responses seems the same “Parents are the one to decide for their children to uptake the vaccine, we preferred our children to be immunized at home because of the cost of transportation” (FGD, Female artisan, trader, civil servants and farmer Tarauni, Kano) other participant unanimously said “Parents and government should decide for the uptake of the vaccine, be it hospital, school and home is ok but we prefer at home for conveniences and reduce the suffering of waiting in the hospital and cost of transportation” At post- intervention responses seems nothing much was added the participants said “Parents are the one to decide for their children to uptake the vaccine, we preferred our children to be immunized at home but after interacting with you we discovered that is good to receive the vaccine in the hospital in case of any eventuality the health care provider can handle it”

Similarly participants also mentioned that “Parents are the ones responsible to decide but if parents are not around adolescents can decide on their behalf, any place for immunization is ok so long as there will be no suffering” but others said “Government and community leaders are the ones to decide for the uptake of the vaccine since is new vaccine to us, like the way they used to do for polio vaccine so that many people will not miss it, be it home, school or hospital is the same but we prefer it at home to avoid suffering of going to hospital” one of the participants lamenting wasting of time in the hospital “I prefer

it at home” because of misconception and rumour that may be going round like polio vaccine “Authority and community leaders have to key in” (FGD, Male civil servants, farmer, artisan and trader Tarauni, Kano) after the intervention most of the participants said “is responsibility of the parents to be in charge of the affairs at home” sometime adolescents may play a role in the absence of their parents “you know we may not be available all the times, so adolescents can take over” but “is responsibility of the government and the community leaders to make sure there is compliance like the way they did during polio round” However, for place to receive the vaccine participants consentaneously said “hospital is the best place but if authority can make it to be house to house or in school is a welcome development”

Comparison between Pre- and Post-Intervention Focus Group Discussions in the control group

1. Respondents’ Knowledge of Sexually transmitted Infections

The knowledge of the common sexually transmitted diseases, among majority of the participants was scanty. A few of them mentioned some; “the sexual transmitted diseases we know are HIV virus and gonorrhoea” (FGD, Female trader, civil servants and artisan. Gwale, Kano.). However, at the end of the study the responses were almost similar but one of the participant added “vaginal infection”

2. Respondents’ Knowledge of Genital malignancies

Regarding knowledge of genital malignancies, most of the participants expressed complete lack of awareness “we are not aware of it but we know breast cancer” (FGD, Female artisans, trader and farmer Gwale, Kano.). At end of the survey, majority of the participants their knowledge about genital malignancies remain the same, other participants said “apart from breast cancer, there is cancer of the stomach”. Similarly, most of the participants said that “We know bladder cancer” (FGD, Male farmer, civil servants and trader Gwale, Kano). But at the end of the study “prostate cancer”

3. Respondents’ Knowledge of HPV Infection

Participants were asked what they knew about HPV Infection, their responses demonstrate lack of knowledge about the infection

"We are not aware of HPV infection" (FGD, Female farmer, trader and artisan Gwale, Kano.) other participants said *"we know vaginal infection especially the one with purulent discharge can transformed to HPV infection"* (FGD, Female artisan and trader Gwale, Kano.). At the end of the study, the participants virtually their knowledge about HPV infection remain the same. However, other participants said *"we don't know anything about HPV infection unless if you are going to educate us now"* (FGD, Male civil servant, farmer and artisan Gwale, Kano.) but one of the participant said that *"I knew genital wart because there was a time patient presented with it in the hospital then our in charge showed me"*.

4. Respondents' Knowledge of HPV Vaccine

Regarding knowledge of HPV vaccine Participants, most of the participants express their ignorance *"We don't know HPV vaccine"* (FGD, Female farmer, civil servants and artisan Gwale, Kano.) other participants said that *"we are not aware of this vaccine but we know vaccine that are given routinely to the children"* (FGD, Female artisan, civil servants and trader Gwale, Kano.). Likewise at the end of the study, the responses remain the same except that one participant said *"I asked my daughter to check internet about this vaccine that is new in our setting"* (FGD, Female civil servants Gwale, Kano.)

Moreover, other participants said that *"we don't know about HPV vaccine, sincerely we are hearing for first time"* (FGD, Male farmer, artisan, trader and civil servant Gwale, Kano.) still it was the same at end of the study *"HPV vaccine eh we don't knew anything about it"* but jokingly one of the participant said *"is good to organised an awareness campaign for this vaccine"*.

5. Assuming there is Vaccine to protect HPV infection how can it help

At both beginning and end of the study most of the participants mentioned that *"HPV vaccine we are ignorant about it"* some body that is ignorance

"how can he know it uses" (FGD, Female trader, civil servants, artisan and farmer Gwale, Kano).

6. What concern do you have about the vaccine

At both beginning and end of the study participants alleged that HPV vaccine is another way of stagnating their population *"family planning method, it side effect in feature"* while others mentioned *"cost of the vaccine"* (FGD, Female artisan, farmer, trader and artisan Gwale, Kano).

7. Decision for the uptake of HPV Vaccine and the preferred place for immunization

Most of the participants were in the opinion *"government and community leaders should decide for the peoples to receive the vaccine in case anything happened they are liable to it"* others mentioned *"parents should decide, but community leaders should also ensure there is compliance as in polio and other immunization programme"* for the prefer place to receive the vaccine majority said *"at home"* some of them said *"in the PHC which is located close to our houses"* but few among them mentioned *"school and hospital"* (FGD, Female trader, civil servants and farmer Gwale, Kano) at the end of the study the responses remain unchanged except some participants said *"community leaders along can handle this issue since they are close to masses"* Another participants unanimously said *"Parents and government should decide for the uptake of the vaccine"* preferably *"we want it at home for conveniences and to reduce the cost of transportation"* others said *"no problem be it at hospital, school or home but we prefer it at home"* (FGD, Male civil servants, trader and artisan Gwale, Kano) At the end of the study almost all the participants their responses remain the same, but one among them said *"Parents are the one to decide everything for their children not even uptake of the vaccine, i prefer my children to be immunized at home in order to have peace of mind laugh follows immediately"*.

DISCUSSION

Despite the vaccine being available in Nigeria since 2009, Before the intervention there was high proportion of the respondents with poor knowledge of HPV infection and vaccine in the intervention and control group respectively, this concurs with the finding reported from Kano State, Nigeria.¹⁷ but is poor than the figure obtained from Lagos State, Nigeria who also reported poor knowledge of HPV infection and vaccine.¹⁸ The variation may be due to differences in educational level.

Few participants were ever heard about HPV infection and its vaccine in both groups. This corresponded to the studies done in Nigeria and Ghana.^{19,18} that reported poor knowledge of HPV infection and vaccine. This study also observed that little proportion of the respondents that knew the risk of having HPV infection like multiple sexual partners, early age at first intercourse and unprotected sex in the both groups respectively. These findings concur with those reported from Lagos and Ibadan, Nigeria.^{20,21} but do not conform to finding of another study in Lagos, Nigeria.¹¹ The disparity may be explained by differences in educational attainment, for recommended number of doses to be given and the category of people to get the vaccine correspond with the finding of a study in Nigeria.⁸ Most of the parents were willing to vaccinate their adolescents despite they recorded low knowledge on HPV infection and vaccine before the intervention, This is supported by study in Edo²² who reported that most of the parents showed high acceptability of HPV vaccine despite low awareness reported regarding this vaccine and this can be attributed to parents attitude in accepting positive health actions that will promote and maintain their child's health.

Reasons reported by parents for willingness to uptake the vaccine for their adolescents in the intervention and control groups as is effective, safe and recommended by health care worker respectively which conforms with the finding reported in other studies^{75,79,93,101} few mentioned that is affordable which is not similar to studies in our setting but corresponded with findings in developed countries^{23,24} but the study have implicated fear of site effect, cost of the vaccine, cultural and religious belief as causes for unwilling to uptake the HPV vaccine the findings concur with the findings of other studies in

different countries.^{21,22,25,26,27} For the preferred place to receive the vaccine are health facility, school and home in the intervention and control groups respectively. This is correlated with the studies in Mali and China^{28,29} and almost half of the respondents they would support HPV vaccine for adolescent boys and girls and as well recommended it to children of their friends or relatives which conforms with study in Ethiopia³⁰ the willingness to support the vaccine among parents of adolescents may be a reflection of the societal response to the introduction of the new vaccine.

This study observed that parents were influenced to uptake the vaccine for their adolescents because it prevent STDs, fear of genital warts and cancer there is strong linked with fear of genital lesion and studies conducted in Nigeria²⁷ and South-Africa.³¹ Parents are the one autonomously decided for the uptake of the vaccine in this study particularly fathers because they were the decisions maker probably because of our cultural background as most of the decisions are taken by family head the findings is in keeping with studies in Mali³² and Ghana³³ but contrary to studies in South-Africa were adolescents exercised a high level of autonomy and decision making to take the vaccine.^{31,34}

The most common source of information about HPV vaccination cited by the participants in this study before the intervention was radio and television rather than family members and friends, newspaper, healthcare provider or the internet as in study in Malaysia³⁵ perhaps not like study in Singapore.³⁶ This large knowledge-information gap shows that much can and should be done in terms of public health education.

The educational intervention in this study has effectively raised knowledge of HPV infection and vaccine in the intervention group. After the intervention, there was marked increase of good knowledge among respondents in the intervention group. The proportion of respondents with good knowledge increased in the intervention group and this increase. Though an increase of good knowledge was seen in the control group, it was not statistically significant. This finding conforms with studies in Nigeria,⁹ Egypt,³⁹ India,³⁷ and China.³⁸ These findings further buttresses the importance of health education intervention in improving the

knowledge of HPV infection and vaccine of the respondents in the intervention group.

At the end of the study, there was an increase in proportion of the respondents that ever heard about HPV infection and its vaccine in the intervention group and this increase was statistically significant. Though an increase was seen among the respondents that ever heard about HPV infection and its vaccine in the control group. Also studies on knowledge and acceptance of HPV vaccine in Nigeria, revealed that the intervention group had significant increase in proportion of the respondents that ever heard of HPV infection and its vaccine than the control group post-intervention indicating that, there was a marked improvement in the respondents' knowledge after an educational intervention^{9,40}

However, there was an increase in the numbers of the respondents that knew HPV is sexually transmitted infection and person being infected without knowing in the intervention group with slight increase seen in the control group which is consonance with other studies^{11,38,41}

After the intervention, there was an increase of the respondents that knew the benefit of HPV vaccine such as prevention of HPV infection; genital wart; cervical cancer and penile cancer respectively in the intervention group which corresponded with results reported in Cameroon and Mali^{42,29} probably because we have almost the same culture and tradition with them, for the recommended number of doses and the category of people to get the vaccine^{43,30}

It is worthy of note that there was marked improvement in the parents' willingness to receive the vaccine for their adolescents in the intervention group after the intervention unlike in the control group where there was minimal improvement. An increase was seen in the intervention group among the respondents who were willing to receive the vaccine for their adolescents after the intervention. This is in line with a study conducted in Abuja where the willingness to accept the vaccine was found to have increased after an intervention.²⁰ It was also found in other studies conducted in China and India where the willingness to vaccinate their children increased following an intervention.^{38,37} The reason given by the parents for their willingness to uptake the vaccine for their

children is effective, safe, affordable and recommended by health care worker respectively improved in the intervention group the findings concurred with other studies in Nigeria^{17,44,22,26} but it is impressive that the intervention disposed respondents' attitude towards the myth and misconception they have about the vaccine like fear of side effect, cost of the vaccine, cultural and religious belief as causes for unwillingness to uptake the HPV vaccine the findings concur with the findings of other studies in different countries^{25,26}. More than half of the respondents preferred to obtain the vaccine in the health facility after the intervention followed by at home and school similar to study in South-Africa.³¹ However, the parents that would support HPV vaccine for adolescent boys and girls and as well recommend it to the children of their friends or relatives markedly improved which conforms with study in Kenya.⁴⁵

There was improvement in terms of what influenced the parents to uptake the vaccine for their adolescents as it prevented STDs; fear of genital warts and cancer the findings corresponded to a study in China.¹² However, after the intervention there was noticeable change in who decided for the children to uptake the vaccine, parents are the one autonomously decided for the uptake of the vaccine, also female adolescents were not left behind probably the consequences of the infection is on them than their counterpart the findings correlate with studies in South-Africa^{31,34} and Thailand²⁸ This shows that the educational intervention was beneficial.

Interestingly, there was an increase about the sources of information on HPV vaccination cited by the participants after the intervention was health care provider followed by radio, family members, newspaper and internet respectively as in study in China.⁴⁷

CONCLUSION

Poor parental knowledge of HPV vaccine and low parental willingness to vaccinate their adolescents' with HPV vaccine was observed before intervention in both communities but following the intervention, there was increase in the parental awareness of HPV vaccine and willingness to vaccinate their adolescents' with HPV vaccine in the intervention community only.

Health education intervention was found to be effective at improving the parental awareness of and willingness to vaccinate their adolescents' with HPV vaccine; there is need for multipronged approach in educating the parents of adolescent about the benefit of HPV vaccine in reducing and preventing the infection and its effects.

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SETTING UP A MODERN RADIOTHERAPY FACILITY IN A WAR-TORN REGION OF NIGERIA: UNIVERSITY OF MAIDUGURI TEACHING HOSPITAL EXPERIENCE

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ABSTRACT

Radiotherapy is a critical component of cancer care and its access in low- and middle-income countries is very poor. Of course, cancer is a global health problem and its incidence is rising in Africa with about 1.5 million case annually. Establishing a technical state-of-the-art radiation therapy facility in a region ravaged by Boko Haram insurgency for close to two decades posed even a greater challenge and due to an important role of radiotherapy in cancer management, an urgent requirement is needed to build an infrastructure that provides such services to address access challenge faced by patients. This work describes our experience in developing a modern radiotherapy centre at epicentre of Boko haram insurgency in Northeast Nigeria. We bring into light our source of funding, engagement with regulatory bodies, technical experts for construction of bunkers and installation of the linear accelerators and brachytherapy machines, manpower strength and training, our collaborations and clinical outcomes among other milestones recorded.

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INTRODUCTION

Cancer is a major public health disease and a leading cause of morbidity and mortality globally, with an estimated 20 million new cases and 10 million deaths in the year 2022.¹ Its incidence, morbidity and mortality have been of the steady rise over the years with approximately 65% to 70% of this increase occurring in low- and middle-income countries (LMICs).¹ The Sub-Saharan Africa region, which are predominantly LMICs, have a disproportionate burden of cancer when compared to high-income countries.¹ In 2022, the mortality-incidence ratio of cancer for Nigeria was 0.62 (79,542 / 127,763) compared to 0.25 (605,761/2,380,189) for the United States of America and 0.40 (181,807/ 454,954) for the United Kingdom.²⁻⁴

In Nigeria, cancer patients generally present late with advanced disease and poor survival outcomes.^{5,6} This is generally due to poor awareness of the general population on cancer; availability and accessibility of comprehensive cancer facility; inadequate skilled cancer health workforce; predominantly catastrophic out-of-pocket expenditure on cancer care.^{5,7}

Radiotherapy, along with surgery and chemotherapy, play critical roles as part of the comprehensive management of cancer patients.⁸ More than 50% of cancer patients will require radiotherapy during the course of their treatment.⁹ Radiotherapy can be administered for curative or palliative intent in cancer patients.¹⁰ It contributes to about 40% improvement of survival in cancer patients.¹¹ Radiotherapy can be in form of teletherapy (e.g., linear accelerators) or brachytherapy.¹² In LMICs, there is dearth of this essential treatment modality, especially in Sub-Saharan Africa and its accessed is highly inadequate with about 34% of optimal radiotherapy capacity in whole of the African

continent. Only 28 African countries out of 54 now have radiotherapy treatment machines to serve their population.^{11,13} Most of the countries in Sub-Saharan Africa with radiotherapy treatment machines have very few relative to their population.¹³ About 54% of these linacs are found in Egypt and South Africa.¹⁴ This is grossly inadequate particularly given the growing burden of cancer in Africa.¹⁴ Furthermore, at that time, only 21 African countries had access to brachytherapy machines with 60% located in South Africa, Egypt and Algeria. This development is happening amidst projected increase in burden of cancer in Africa with about 1.5 million cases per year from 2020 with possible doubling of the death rate.¹⁴

Nigeria has grossly inadequate radiotherapy facilities compared to its enormous population of over 230 million people, with gross disparity in its distribution across the geopolitical zones.¹⁶ According to the International Atomic Energy Agency criterion of one LINAC megavoltage machine for every 400 patients with cancer, Nigeria has a shortfall of around 280 LINACs.¹⁶

It was within this context that the University of Maiduguri which was established in 1982, as a foremost tertiary institution serving the entire North east geopolitical region and beyond built a modern radiotherapy facility to serve the North East geopolitical region and entire Nigerian population despite being rampaged by close to two decades of Boko Haram insurgency crisis that wrecked enormous damage to social infrastructure, caused deaths of thousands, and displacement of millions of people in the North East. We believe that sharing our experience in setting up this facility is noteworthy, and it can be used as a model for other unstable developing countries or regions.

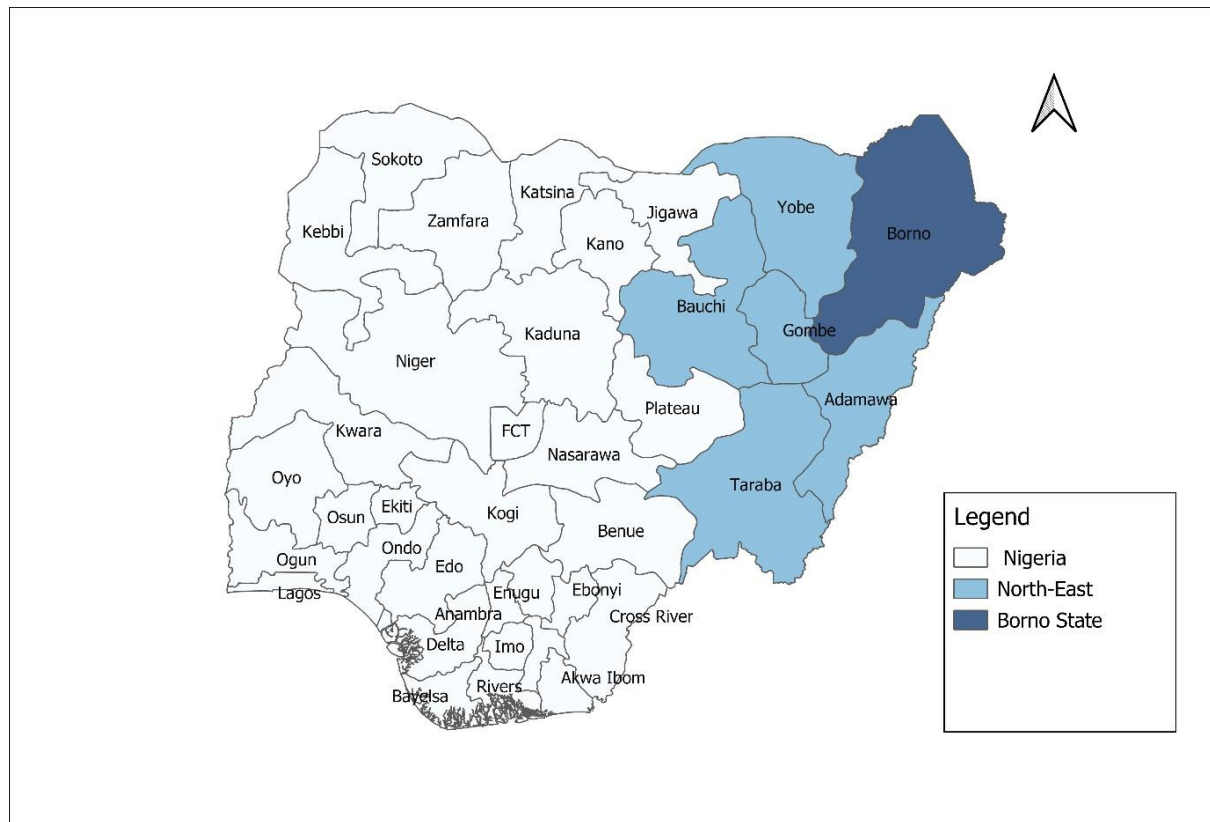


Plate 1. Map of Nigeria showing Borno State within the North East region

MATERIAL AND METHODS

This is a descriptive report of steps, approaches and challenges of establishment of University of Maiduguri Cancer Centre and outcomes associated with it. Tables, pictures and simple descriptive statistics were used to help drive the narrations.

RESULTS

Needs assessment

As at 2010, there were only 8 external beam radiotherapy and 5 brachytherapy machines in the entire country, with the North East geopolitical region having only one brachytherapy machine (Table 1).¹⁷ There was no comprehensive cancer centre that could offer radiotherapy to cancer patients from the Northeast geopolitical region

comprising of a population of over 21 million people who were mostly devastated by insecurity as a result of *Boko Haram* insurgency.^{18,19} Patients from this region had to travel hundreds of kilometers to access radiotherapy services in other regions of the country which were largely not affordable to majority of them. In addition, they had to contend with long queues of patients waiting for their turn on radiotherapy machine. There was a high dose rate brachytherapy machine situated in one of the North East states in Federal Medical Centre Gombe, but it was limited in function as it treated only cervical and other uterine cancers after receiving external beam radiotherapy from other radiotherapy centres. It was therefore very clear to stakeholders that even within the general impoverished setting of radiotherapy availability in Nigeria, the North East region was grossly underserved.

Table 1. Distribution of radiotherapy facilities in Nigeria at end of 2010.¹⁷

| Geopolitical zone | Radiotherapy center | Radiotherapy facility | | | | |
|-------------------|---------------------|-----------------------|-------|-------------------|-------------------|-----------------------------------|
| | | Cobalt-60 | LINAC | LDR brachytherapy | HDR brachytherapy | Treatment planning/imaging system |
| South West | LUTH, Lagos | ---- | 1 | --- | 1 | CT scan |
| | UCH Ibadan | 1 | --- | 1 | --- | --- |
| | Eko Hospital, Lagos | 1 | --- | --- | --- | --- |
| North West | ABUTH, Zaria | 1 | --- | 1 | --- | --- |
| | UDUTH, Sokoto | --- | 1 | --- | --- | 1 CT simulator |
| South East | UNTH, Enugu | --- | 1 | --- | --- | 1 CT-simulator |
| North East | FMC Gombe | --- | ---- | --- | 1 | ---- |
| FCT Abuja | NHA, Abuja | --- | 1 | 1 | --- | 1 simulator |
| South South | UBTH Benin | | 1 | | | 1 CT- simulator |
| North Central | --- | --- | --- | --- | --- | --- |

Table adapted with modification from Nwankwo et al 2013¹⁷

Conceptualization

The earliest documented attempt to establish a cancer center was in 2005 when the Federal Government approved of the inclusion of University of Maiduguri Teaching Hospital (UMTH) amongst the tertiary institution to be provided with external beam radiotherapy. To this effect, a site was identified and cleared within the

teaching hospital complex. However, the project was abandoned due to lack of funds backing. There were subsequent background attempts to draw attention of critical stakeholders from government and non- governmental organisations to establish a cancer center in UMTH, but with little success.

Early recruitment and training of manpower

In 2012, there was another strong wave by the management of UMTH to push further the agenda of establishing a cancer center and the idea of commencement of training of the cancer workforce was conceived. To this effect, the first set of healthcare workers including two resident doctors, two radiographers and one physicist, were sent to various institutions within and outside Nigeria for specialized training to become

Radiation Oncologist, therapy radiographers and medical physicist respectively. By 2019, they had largely returned which became an impetus for the management of UMTH to make another push for the establishment of the cancer center

Approval and funding

Through the special intervention of the then President of the Federal Republic of Nigeria, Muhammadu Buhari, and approval was granted in 2019 for the establishment of a comprehensive cancer center in UMTH, with full funding which was sourced by the Central Bank of Nigeria and given rapid appropriation by the National Assembly. The approval was to build a radiotherapy center with four bunkers to house two Linear Accelerators, two high-dose rate brachytherapy and one CT simulator.

Development of physical infrastructure

A new site for the cancer center was identified in 2019 by the management of the hospital which was relatively isolated from the central areas of the hospital. Environmental impact assessment was done by a combined team of geologists, physicists and civil engineers. After certification of fitness of the identified space, application for building license was made to the Nigerian Nuclear Regulatory Authority (NNRA). The building plan for the bunkers were approved after thorough review and adequate surveys. The construction of the bunker began late in 2019 in the midst of worsening insurgency, which led to interruptions in the smooth flow of work on many occasions. The construction of the bunkers was regularly supervised by officials of the NNRA. Upon completion of the bunkers, they certified its integrity after thorough checks.

Procurement, acceptance, installation, and commissioning of radiotherapy facilities

Importation of the radiotherapy facilities was done after obtaining license from NNRA in (specify month/year). The machines procured include Two Elekta linear accelerators, one Elekta high dose rate brachytherapy, one Varian high dose brachytherapy and a Canon CT simulator. They were formally accepted by the UMTH management on the (specify date). License for installation of the equipment were obtained and gradual installation of the radiotherapy machines began. The installation was painstakingly carried out over a period of (specify) months. At the end of the installation, the equipments were test run and certified to be in good working condition. Then another license for commissioning was obtained for commissioning of the facility. The commissioning took place in August 2023. The first person treated was a 68-year old prostate cancer patient with brain metastasis in August 2023 (Plate 4), thus began the journey of radiotherapy treatment in UMTH, Maiduguri, Borno State.



Plate 2. Setting up the foundation of the UMTH Cancer Center 2019



Plate 3. One of the two linear accelerators installed in UMTH Cancer Centre at commissioning in 2023



Plate 4. First patient treated with external beam radiotherapy in UMTH Cancer Center in August 2023

Collaborations and hands-on application trainings

There were numerous collaborations between UMTH Cancer center and many institutions within and outside Nigeria, mainly to train the various cadre of workforce in the new cancer center. The trainings were carried out abroad and locally on the machine. The radiation oncologists, therapy radiographers, physicists and oncology nurses were trained on the numerous aspects of operating of the radiotherapy machines. This included CT simulation, uploading data, contouring, treatment planning, patient set-up and actual treatment. The prominent institutions of formal collaboration with UMTH Cancer Center include Clatterbridge Cancer Centre,

Liverpool, United Kingdom, Clinic d' Oncologie 16 Novembre, Rabat, Morocco, The Centre International de Cancerologie de Lome, Togo, Usman Danfodio University Teaching Hospital, Sokoto and National Hospital Abuja.

Staff development and growth

Table 2 show the staff strength of UMTH Cancer Center from August 2023 and August 2024. There has been steady growth in the number and quality of staff. The clinical staff have been exposed series of training within and outside the hospital to improve their skills, effectiveness and efficiency in management of cancer patients.



Plate 5. During one of the hands-on training from international collaborations with UMTH Cancer Center

Table 2. Staff strength of UMTH Cancer Center over the period of one year

| Staff Cadre | August 2023 | August 2024 |
|--|-------------|-------------|
| Consultant Radiation and Clinical Oncologists | | |
| Resident Consultant | 1 | 1 |
| On Sabbatical | 1 | --- |
| Visiting Consultant | 2 | 5 |
| Resident Doctors | --- | 4 |
| Therapy Radiographer | 4 | 14 |

| | | |
|-----------------------------|-----|----|
| Medical Physicist | 4 | 6 |
| Nurses | | |
| Oncology Nurses | 5 | 5 |
| General Nurses | --- | 6 |
| Support staff | | |
| Administrative staff | 3 | 3 |
| Health information officers | 4 | 4 |
| Porters | 2 | 2 |
| Janitors | 8 | 8 |
| Security Officers | 6 | 7 |
| Total staff | 40 | 65 |

Accreditation for residency training for UMTH Cancer Center

The UMTH Cancer Center applied for accreditation to commence training of radiation and clinical oncologists, as a way of producing needed manpower. The accreditation team from the West African College of Surgeons assessed the center and approved full accreditation to commence residency training. To this effect, the first set of resident doctors (four in number) were employed and have since commenced residency training from July 2024.

Clinical output of UMTH Cancer Centre

The UMTH Cancer Center within a short period of time, became a center for referral of cancer patients not just for patients from North east geopolitical region, but from across the states of the Federation. The center provided outpatient clinics on two days per week, CT simulation, Contouring, treatment planning, and actual external beam radiotherapy and brachytherapy. Furthermore, administration of chemotherapy to patients as well as admission in wards for

resuscitation and blood transfusion. At the peak of events, the Center attended to an average of 60

patients in the outpatient clinics per week which consisted of new patients, and those on treatment or follow up. An average of 56 (minimum 44, maximum 72) patients were treated on the machine for eternal beam radiotherapy per day (excluding weekends). Furthermore, an average of 6 cervical cancer patients were treated per week on high dose rate brachytherapy, while 15 patients receive chemotherapy per week on the average.

Evaluation of cancer patients who completed treatment with external beam radiotherapy from August 2023 to September 2024, about a year period, showed that a total 697 patients received external beam radiotherapy, with 539(77.3%) and 158(22.7%) being for curative and palliative intents respectively. The mean age of the patients was 49.06±15.24 years. Figure 1 shows the age distribution of cancer patients receiving treatment at UMTH Cancer Centre. There were 408(59%) females and 289(41%) males (Figure 2).

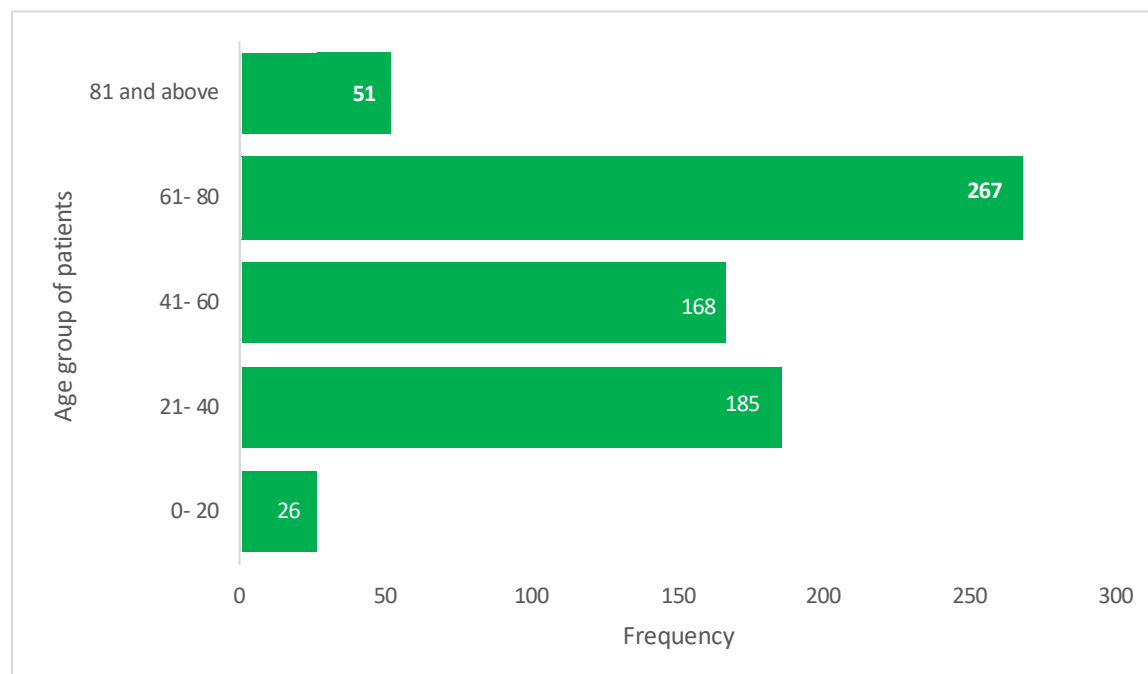


Figure 1. Age distribution of cancer patients who received external beam radiotherapy in UMTH Cancer Center August 2023 to September 2024

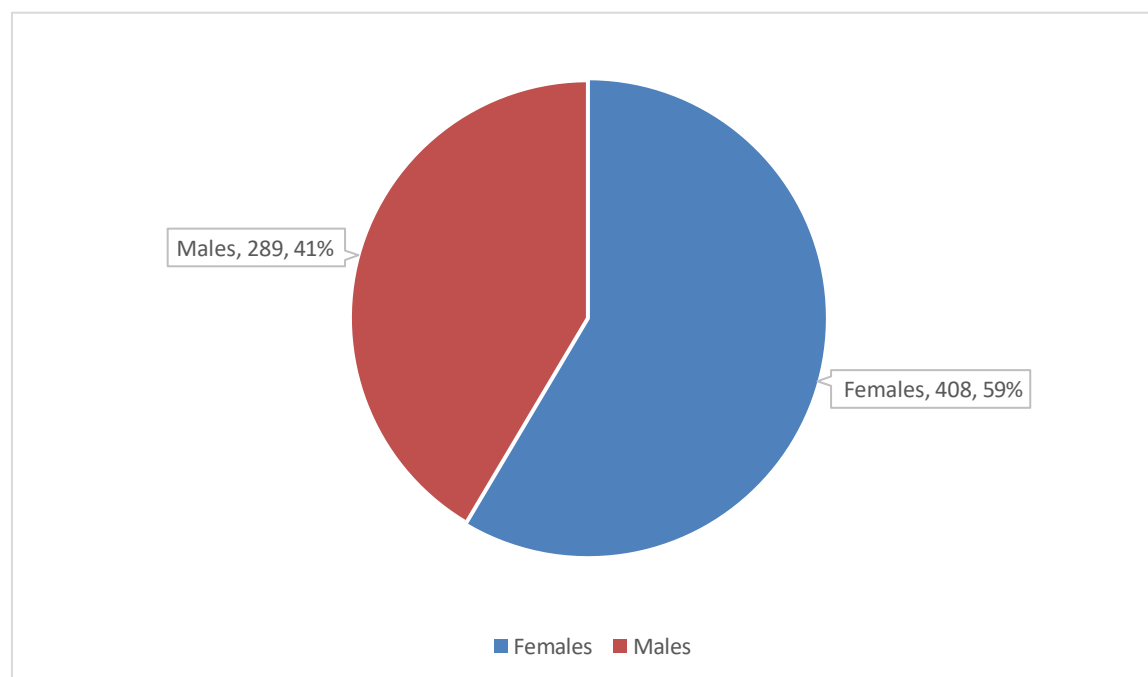


Figure 2. Distribution of gender of cancer patients who received external beam radiotherapy in UMTH Cancer Center August 2023 to September 2024

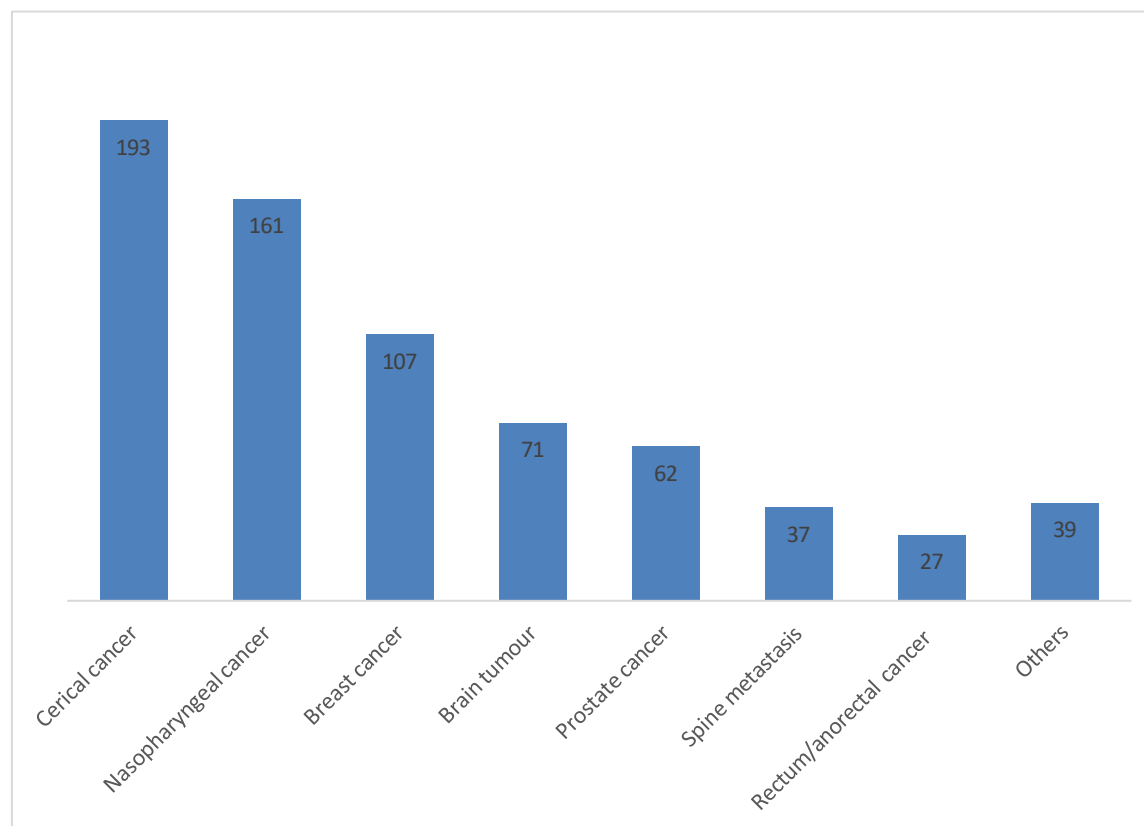


Figure 4. Distribution of site of cancer diagnosis of patients who received external beam radiotherapy in UMTH Cancer Center August 2023 to September 2024

Contribution of UMTH Cancer Center to management of cancer in Nigeria

Within a period spanning about a year from its commissioning in August 2023 to September 2024, the UMTH Cancer Centre treated 697 patients with external beam radiotherapy and 56 patients with high dose rate brachytherapy. Thus contributing significantly towards cancer management in Nigeria. The centre received referrals not just from North-eastern states but from all over Nigeria. Furthermore, the centre received and treated international patients from Niger, Chad Republics and Cameroon. The

UMTH Cancer Centre had the cheapest service fees and is one of the most patient-friendly radiotherapy center in the country, making it a top choice for many cancer patients from diverse socio-cultural backgrounds. Furthermore, the radiotherapy treatment waiting time was relatively shorter with a median duration of 10 – 14 days. The UMTH Cancer center, therefore contributed immensely to the provision of radiotherapy services to cancer patients in Nigeria (Table 2).

Table 2. Distribution of functional radiotherapy facilities in Nigeria as at September 2024

| Geopolitical zone | Radiotherapy center | Radiotherapy Facility | |
|-------------------|--|-----------------------|------------------------------|
| | | Linear accelerator | High dose rate brachytherapy |
| South West | | | |
| | NSIA- LUTH, Lagos | 3 | 2 |
| | UCH Ibadan | --- | 2 |
| | Eko Hospital, Lagos | 1# | --- |
| | Marcelle Ruth Cancer Center, Lagos | 1 | --- |
| North West | | | |
| | ABUTH, Zaria | --- | 1 |
| | UDUTH, Sokoto | 1 | 1* |
| | Muhammad Buhari Cancer Center, Kano | 2 | 1* |
| South East | | | |
| | UNTH, Enugu | 1 | --- |
| | David Dave Umahi Cancer Center, Abakili Ebonyi | 1 | - |
| | American Cancer Hospital, Ikeduru, Imo State | 1# | -- |
| North East | | | |
| | FMC Gombe | ---- | 1 |
| | UMTH Maiduguri | 2 | 2 |
| FCT Abuja | | | |
| | NHA, Abuja | 2 | 1 |
| South South | | | |
| | UBTH Benin | -- | 1 |
| | Asi Upko Cancer Center, Calabar | 1 | 1* |
| North Central | --- | --- | --- |

#Do not have Linear accelerator but Cobalt-60

*Have HDR brachytherapy that has not been commissioned

Maduguri Flood Disaster and its effect on UMTH Cancer Center

The Maiduguri flood disaster was an overwhelming event that occurred on 10th September 2024 as a result of the collapse of the Alau Dam due to torrential rainfall. Over half of the land mass of Maiduguri and Jere Local Government Areas were submerged in the flood for days before it receded. It led to displacement of significant proportion of the populace who

faced numerous health risks and food insecurity. The flood also damaged many infrastructure including roads, bridges, buildings and the zoo. There were over 100 deaths from the flood and several people unaccounted for.

Unfortunately, the entire UMTH complex was submerged in the flood for days and the radiotherapy facilities were not spared. The linear accelerators, high dose rate brachytherapy, CT simulator and many of their accessories were

partly submerged in the flood water for days. All the radiotherapy facilities could no longer function due to the damages from the flood, thus bringing an abrupt stop to radiotherapy. After the flood receded, some of the patients on treatment who returned back to the Center were referred to other functional radiotherapy centers, while skeletal outpatient clinics, chemotherapy and ward admissions were retained, along with residency training.

Post flooding recovery

The Maiduguri flooding has generally attracted attention of the federal Government, international and local non-governmental organizations. There has been outpouring of sympathy on the damaged radiotherapy facilities. Various teams from Federal Ministry of Health, and other partners have come to the UMTH Cancer Center to assess first-hand the level of damage. There are currently high-level engagements with Federal Ministry of Health, national Agency on Cancer Research and Treatment (NICRAT), the International Atomic Energy Agency (IAEA) and other partners on the cost of replacing or repairing the damaged the radiotherapy facilities; and strategies to mobilise the required funding.

Currently, the activities of the UMTH Cancer Center has been grossly reduced. The referral from centers across the country have stopped as external beam radiotherapy and brachytherapy are temporarily non- functional. However, the weekly outpatient clinics, chemotherapy administration, and residency trainings are still being conducted.

DISCUSSION

The University of Maiduguri Teaching Hospital (UMTH) Cancer Center was indeed a very successful project, which recorded instant impact, and gained wide acceptability by stakeholders in cancer care and was a favourite choice for cancer patients from diverse socio-economic backgrounds. This is demonstrated by the high level of patronage of UMTH for radiotherapy services from across all the geo-

political zones of Nigeria and neighbouring countries like Chad, Niger and Cameroun Republics. Within a span of a year, 697 cancer patients were treated in UMTH Cancer Center. Furthermore, relieved cancer patients from Borno State and other North Eastern States who mostly had travel over 400 kilometers to access chemotherapy and radiotherapy services in other geo-political regions, by bringing comprehensive cancer care to their vicinity. At the peak of its operation, the center was one of the few centers in the country that offered chemotherapy, external beam radiotherapy and brachytherapy, thus sealing its position as a comprehensive cancer centre. The successes of the UMTH Cancer Center were achieved as a result of a combination of factors. First, visionary, dedicated and proactive leadership of the UMTH management led by the Chief medical Director, Prof. Ahmad Ahidjo. Second factor was the buy-in of the Federal Government and other critical stakeholders who provided the huge funding and support for the building and purchase of the radiotherapy equipment. Third, is the general ownership of the project by the healthcare workers, community and even specialists from neighbouring tertiary health centers who put in efforts to support the cancer center in numerous ways and also helped fill in critical gaps in healthcare workforce. These factors together with the relative cheaper fees of radiotherapy services at UMTH Cancer Center led to the overwhelming patronage from Nigerians, far and wide. These successes were similar to those recorded in establishing new radiotherapy facilities in some LMIC in Africa, including Rwanda, Ethiopia, among others.^{14, 20}

Despite the enormous successes recorded by the UMTH Cancer Center, there were many challenges faced in running the centre. First, skilled manpower to run the centre was limited. There was general shortage of radiation oncologists, medical physicists, therapy radiographers and biomedical engineers across Nigeria, and difficulty in attracting these few from other regions to practice in Maiduguri, a town devastated by the *Boko Haraam* insurgency. Secondly, most of the cancer patients requiring radiotherapy are indigent patients. Many are unable to afford radiotherapy ab ignition, while

others struggle to pay for the different radiotherapy services, as they experience financial toxicity while undergoing treatment. The only available mode of payment for the radiotherapy services in UMTH Cancer Center was out-of-pocket expenditure. The center was not included as part of those enrolled in the Cancer Health Fund (CHF), which is a scheme of the Federal Government that enrolls indigent cancer patients to finance their cancer treatment. Neither does the National Health Insurance cover for radiotherapy treatment of patients. These factors have made access to radiotherapy difficult or limited for many of the patients who have to pay out-of-pocket for these services. These challenges are very similar to what is obtainable in other low-income countries.²¹⁻²⁴ For instance, in Rwanda, the health insurance covered 90% of cost of radiotherapy treatment, but most cancer patients are still indigent and struggle to pay for the 1remAINING 10% of cost, out-of-pocket.¹⁴

The Maiduguri flood disaster that brought to a halt the radiotherapy treatment of patients in UMTH Cancer Centre, was a natural disaster that

was novel to our setting. To the best of our knowledge, there has been no other radiotherapy centre in the country that has been affected by a natural disaster previously. It has brought to the limelight the need for the design of our radiotherapy centres to be more robust and resistant to disasters like flood, fire outbreaks; and also, the congenit need for the radiotherapy facilities to be insured against unforeseen incidences and natural disasters.^{22, 25}

CONCLUSION

The UMTH Cancer Centre project has been a huge success with great impact, providing access to radiotherapy to Nigerians and increasing the cancer workforce and facilities in the country. There are many challenges faced in running the Cancer Centre which include shortage of qualified skilled health workforce and out-of-pocket expenditure of cancer patients. There is need for similar efforts to be replicated across various regions of Nigeria and also other low-and-middle-income countries to help bring access to radiotherapy services available, accessible and affordable.

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PREVALENCE OF ANAEMIA IN PREGNANT WOMEN ATTENDING ANTENATAL CARE AT A TERTIARY HOSPITAL IN NORTHERN NIGERIA.

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ABSTRACT

Background: Anaemia in pregnancy is a common problem in developing and developed nations. It is one of the major causes of maternal mortality and morbidity across the globe especially in the developing countries. Hence, this study aimed to determine the prevalence and severity pattern of anaemia among pregnant women in northern Nigeria.

Methods: In this hospital-based cross-sectional study, 229 pregnant women were systematically selected from April to July 2021 at antenatal care clinic of the Obstetrics and Gynaecologic department of the hospital. An interviewer-administered questionnaire was used to collect data on Socio-demographic, antenatal profile, maternal cultural practices, lifestyle practices, clinical examination and laboratory parameters of the participants. Data were analysed using descriptive statistics.

Results: A total of 229 pregnant women were recruited in the study. The prevalence of anaemia was 31.9%, with 66%, 27% and 7% having mild, moderate and severe anaemia respectively. Based on red blood cell morphologic classification of anaemia, 82% of the anaemic pregnant women had microcytic anaemia, 17% had normocytic, and 1% had macrocytic anaemia.

Conclusion: This study revealed a high prevalence of anaemia in pregnancy, classifying it as a moderate public health problem. To address this, comprehensive antenatal care is recommended, including proper hygiene practices, deworming, malaria prophylaxis, appropriate use of haematinics, and the use of insecticide-treated nets.

Keywords: pregnant women; prevalence and pattern, anaemia, northern Nigeria

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INTRODUCTION

Anaemia in pregnancy is a global health problem and one of the commonest medical conditions in pregnancy.¹ It is an important cause of maternal as well as perinatal morbidity and mortality, especially in low-income countries.¹ Primary health care Physicians are the first contact Physician in the community who can play a very important role in identification and treatment of anaemia.² Many issues associated with anaemia can be assessed and modified at the primary care level. Availability of local data on the magnitude and related predictors has a significant role in managing and preventing anaemia in pregnancy. Given the morbidity and mortality associated with anaemia in pregnancy, more research is needed on its current burden in Kano state. Anaemia occurs at all life cycle stages, but pregnant women and young children, especially preschool, are the most vulnerable.¹ Pregnancy as a physiological state may increase the burden of anaemia because of the dilution effect of the pregnancy, changes in the immune system associated with pregnancy, and increased susceptibility to some of the aetiological factors.³ Anaemia is a medical condition in which the red blood cell number or their oxygen-carrying capacity is inadequate to meet physiologic needs. It is traditionally described as a haemoglobin (Hb) value that is less than two standard deviations below the median value for a healthy matched population by age, sex, altitude, and pregnancy status.⁴

World Health Organization (WHO) defines anaemia in pregnancy as haemoglobin (Hb) of less than 11g/dl or haematocrit concentration of less than 33% in peripheral blood in any stage of pregnancy, while Centres for Disease Control and Prevention (CDC) defines anaemia as pregnancy haemoglobin less than 11 g/dl or haematocrit of less than 33% in the first and third trimester and less than 10.5 g/dl or haematocrit of < 32.5% in the second trimester.^{1, 5} According to WHO, during pregnancy, anaemia may be classified into three levels of severity: mild anaemia (Hb) levels 9 to 10.9g/dl), moderate anaemia (Hb 7 to 8.9b/dl), and severe anaemia (Hb drops less than 7g/dl).⁶ Anaemia is under-reported in most

developing countries, even though it is one of the most prevalent public health problems and has serious consequences for national development.⁷ Globally, anaemia affects about 1.62 billion people, of which 56 million are pregnant women.⁸ Global data estimated the prevalence of anaemia in pregnancy in high-income countries to be 14% and 56% in low-income countries.^{9,10} Anaemia in pregnancy shows remarkable continental variations; sub-Saharan Africa shows 57% prevalence, South-east Asia 48%, and south America 24.1%^{9,10} The wide variations in the prevalence rates might be due to differences in aetiological factors, socio-demographic characteristics, lifestyles, and health-seeking behaviour across different cultures.^{9,10}

It varies from region to region in Nigeria, with a reported prevalence of 36.2% in Anambra and 39.2% in Sokoto.^{11,12} Of these, 90% have a nutritional Iron deficiency as the cause of anaemia in pregnancy.^{11,12}

METHODOLOGY

Study site and population:

The cross-sectional study was conducted at the Obstetrics and Gynaecologic Antenatal care (ANC) clinic of Aminu Kano Teaching Hospital (AKTH), Kano. It is a 700 beds capacity hospital and serves as a referral center to the neighboring states. Patients in ANC are seen by Consultants, O&G residents and Family Medicine residents on O&G posting. Based on the hospital record, an average of 400 pregnant women are seen weekly in ANC clinic.

All pregnant women age 15-49 years who attended the Obstetrics and Gynaecologic ANC clinic of AKTH during the study period (April and July 2021) were recruited for the study. Pregnant women who required emergency care such as severe preeclampsia, antepartum haemorrhage, severe asthmatic attack and diabetic complications were excluded from the study. Pregnant women who had a recent history of blood transfusion (within the past three months) were also exempted from the study.

Sample size estimation

A sample size of 229 was estimated using the Cochran formula¹³ $n = Z\alpha^2 pq/d^2$ where; n = minimum sample size, $Z\alpha$ = standard normal deviate corresponding to a 5% level of significance (1.96), P = (prevalence rate of 17% for anaemia in pregnancy obtained from a similar study).¹⁴

$q = 1-p$ (83%), proportion of pregnant women without anaemia. d = level of precision which was set as 5%. Anticipated response rate was 90%.

Sampling technique

A systematic random sampling technique was used to recruit consenting 229 pregnant women attending the ANC Clinic over 12 weeks. The Obstetrics and Gynaecology ANC Clinic were run four days in a week, and on each clinic day, an average of 100 pregnant women were seen. Therefore, an average of 400 women were seen every week (100 x 4). The sample frame was (400 x 12) over the proposed study period of 12 weeks = 4,800 and the sampling interval was 4,800/229 = 21. At the beginning of the study, the first participant was randomly chosen from the first 21 pregnant women by balloting, in which they were told to pick from 21 scrolled paper with only one "yes". The patient that picked "yes" was taken as the first participant, thereafter every 21st pregnant women were recruited if she satisfied the inclusion criteria. Patients who did not meet the inclusion criteria were skipped, and the next participant before them was recruited. An average of 5 participants were recruited each day, and 20 patients were recruited each week over the study period of 12 weeks.

Study protocol

Two research assistants were trained for this study. A face-to-face interview using a semi-structured pre-tested interviewer-administered questionnaire in English and Hausa languages were given to each participant to collect data on sociodemographic characteristics.

A venous blood sample were taken, for measuring full blood count using automated haematology analyser.³⁵ A drop of blood was placed on new slide, and thin smear was prepared. After being air-dried, labeled with identification number, the smear of the slide was fixed with

absolute methanol and the smear was stained with Giemsa solution based on the standard operational procedures (SOPs) and examined at 10× and 100× microscopic objectives.³⁵

Anaemia in pregnancy was defined as packed cell volume PCV of less than 30%.³⁵ Based on the severity, women were classified into mild (PCV 27- 29%), moderate (PCV 19- 26%) and severe (PCV below 19%) regardless of their gestational age.³⁵ Manufacturer references was used to define mean corpuscular volume (MCV), < 80 FL (microcytic anaemia), MCV 80- 100 FL (normocytic anaemia) and MCV > 100 FL (macrocytic anaemia). Mean corpuscular haemoglobin (MCH) < 27pg and mean corpuscular haemoglobin concentration (MCHC) < 32g/dl for hypochromic anaemia.³⁵ Red cell distribution width (RDW) > 15% indicate high RDW, and this is usually seen in microcytic and macrocytic anaemia. White cells count of < 4 x 10⁹/L or > 11 x 10⁹/L might be seen in infection. Platelet count cell < 120 x 10⁹/L indicate thrombocytopenia which can occur in haemolytic and haemorrhagic causes of anaemia in pregnancy.

Ethical considerations:

IRB board name: Research Ethical Committee of Aminu Kano Teaching Hospital

Approval number: No.

NHREC/28/01/2020/AKTH/EC/2931

Date of approval: 20/11/2020.

The procedures of the research adhered to the ethical guidelines of the Declaration of Helsinki such that informed consent was obtained from each participant before recruitment into the study. Taking part in this research study was voluntary.

Data analysis

The data obtained were collated, coded and filtered in the excel spread sheath before exporting into the IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp. This was to correct errors such as double entry and wrong values before analyses. Quantitative variables such as age, and PCV were described using measure of central tendency (mean, median) and measures of dispersion (range, standard deviation) as appropriate. Other quantitative variables like partner's age, household income, and number of deliveries were re-categorised into groups and were summarised

into frequencies and percentages. Similarly, categorical variables such as marital status, religion and tribe were summarised into frequencies and percentages. Data were presented in the form of charts or tables as appropriate.

RESULTS

A total of 229 respondents completed the study (100% response rate). The age of the participants ranged from 18 to 49 years and the mean age was 29.17 (SD± 6.133) years. The majority of the participants, 27.9% belonged to the age group 25– 29 years. Most of the participants 84.3% resides within the urban area while 15.7% resides in the rural area. There was preponderance of Muslims (86.0%) in the study. The majority of

the participants were Hausa 52.4%, followed by Fulani 22.7%, Yoruba 4.4% and Igbo 7.0%. Other ethnic groups constituted the remaining 13.5%.

Two participants (0.9%) had no form of education, 6 (2.6%) had only 5 (2.2%) had primary education, 87 (38.0%) had secondary education, while 129 (56.3%) had tertiary education. Of the 229 that were married, 76.4% were in a monogamous setting, while 23.6% were in a polygamous setting.

Other socio-demographic characteristics of the study participants are shown in table 1a and b below

Table 1a: Socio-demographic characteristics of the study participants (n = 229)

| Characteristics | Frequency (n) | Percentage (%) |
|-----------------------------------|---------------|----------------|
| Maternal age group (years) | | |
| 15-19 | 7 | 3.1 |
| 20-24 | 49 | 21.4 |
| 25-29 | 64 | 27.9 |
| 30-34 | 60 | 26.3 |
| 35-39 | 34 | 14.8 |
| 40-44 | 11 | 4.8 |
| 45-49 | 4 | 1.7 |
| Residence | | |
| Rural | 36 | 15.7 |
| Urban | 193 | 84.3 |
| Marital status | | |
| Married | 229 | 100 |
| Religion | | |
| Islam | 197 | 86.0 |
| Christianity | 32 | 14.0 |
| Tribe | | |
| Hausa | 120 | 52.4 |
| Fulani | 52 | 22.7 |
| Yoruba | 10 | 4.4 |
| Igbo | 16 | 7.0 |
| Others | 31 | 13.5 |
| Family structure | | |
| Nuclear | 170 | 74.2 |
| Extended | 59 | 25.8 |
| Family size | | |
| 2-4 | 125 | 54.6 |
| 5-8 | 65 | 28.4 |
| >8 | 39 | 17.0 |
| Family setting | | |
| Polygamous | 54 | 23.6 |
| Monogamous | 175 | 76.4 |

Table 1b: Shows the socio-demographic characteristics of the study participants (n = 229)

| Characteristic | Frequency(n) | Percentage (%) |
|------------------------------------|--------------|----------------|
| Partners occupation | | |
| Civil servant | 116 | 50.7 |
| Trading | 49 | 21.4 |
| Self employed | 62 | 27.0 |
| Farming | 0 | 0.0 |
| Unemployed | 2 | 0.9 |
| House income (N) | | |
| <N25,000 | 19 | 8.3 |
| N25,000-N50,000 | 83 | 36.2 |
| N51,000-N75,000 | 46 | 20.1 |
| N76,000-N100,000 | 26 | 11.4 |
| >N100,000 | 55 | 24.0 |
| Maternal occupation | | |
| Civil servant | 45 | 19.7 |
| Trading | 15 | 6.6 |
| Self employed | 52 | 22.7 |
| Farming | 1 | 0.4 |
| Unemployed | 116 | 50.6 |
| Partners education status | | |
| None | 1 | 0.4 |
| Quranic | 1 | 0.4 |
| Primary | 3 | 1.3 |
| Secondary | 44 | 19.2 |
| Tertiary | 180 | 78.7 |
| Maternal educational status | | |
| None | 2 | 0.9 |
| Quranic | 6 | 2.6 |
| Primary | 5 | 2.2 |
| Secondary | 87 | 38.0 |
| Tertiary | 129 | 56.3 |

The majority of the participant's partners, 116 (50.7%) were civil servants. This was followed by self-employed 62 (27.1%), and only 2 (0.9%) were unemployed. Most of the participants, 83 (36.2%), had a monthly household income of between N25,000-N50,000. Fifty-five participants, (24%) earned more than N100,000. Forty-six participants, (20.1%) earned between N51,000 to N75,000, 26 (11.4%) participant earned N76, 000 –100,000 and only 19 (8.3%) earned less than N25,000. Most of the participants, 116 (50.7%) were unemployed. This was followed by self-employed 52 (22.7%), civil servant 45 (19.7%), trading 15 (6.6%) and farming 1 (0.4%). Majority of the participants 78.7% had tertiary education while 22.3% below tertiary educational level. One hundred and

twenty-nine (56.3%) had tertiary education while 43.7% below tertiary educational level. The majority of pregnant women were multigravida 83 (36.2%), followed closely by Primigravida 81 (35.4%) and grand multigravida 65 (28.4%). The majority of the participants, 152 (67.7%), 155 (67.7%) and 124 (54.1%), had started Iron, folic acid, and SP respectively, before enrolling into the study. Most of the participants 67.7% used LLITN during the current pregnancy while 32.3% of the participants did not use.

Table 2a and 2b shows the fetomaternal characteristic of the women. One hundred and forty-two 142 (62.0%) participants started their ANC in the second trimester while 86 (37.6%) commenced their ANC in the third trimester. Seventy-four (32.3%) of the participants had inter-pregnancy of less than 18 months while 33.6% had inter-pregnancy interval of greater than 18 months. Majority of the participants reported no febrile illness in index pregnancy 79.9% while 20.1% reported febrile illness in the index pregnancy.

Most of the participants 93.4% had singleton foetus while 6.6% had multiple gestation.

Majority of the participants 70.7% reported no vagina bleeding in index pregnancy while 29.3% had vagina bleeding in index pregnancy.

Most of the pregnant participants 89.5% had no prior history of heavy menstruation while 10.5% had prior history of heavy menstruation. Majority of pregnant participants did not use contraceptives before pregnancy while 29.3% had used it in the past.

Table 2a: Fetomaternal characteristic of the study participants (n = 229)

| Characteristic | Frequency(n) | Percentage (%) |
|--|--------------|----------------|
| Time of initiation of ANC | | |
| Second trimester | 143 | 62.4 |
| Third trimester | 86 | 37.6 |
| Iron tablet intake in current pregnancy | | |
| Yes | 152 | 67.7 |
| No | 77 | 32.3 |
| Folic acid intake in current pregnancy | | |
| Yes | 155 | 67.7 |
| No | 74 | 32.3 |
| SP taken during current pregnancy | | |
| Yes | 124 | 54.1 |
| No | 105 | 45.9 |
| Sleep under LLITN | | |
| Yes | 155 | 67.7 |
| No | 74 | 32.3 |
| Use of any birth control | | |
| Yes | 67 | 29.3 |
| No | 162 | 70.7 |
| Vaginal bleeding during current pregnancy | | |
| Yes | 18 | 29.3 |
| No | 211 | 70.7 |
| Heavy bleeding during menstruation | | |
| Yes | 24 | 10.5 |
| No | 205 | 89.5 |
| Recent febrile illness | | |
| Yes | 46 | 20.1 |
| No | 183 | 79.9 |
| Inter-pregnancy interval | | |
| <18 months | 74 | 32.3 |
| ≥18 months | 77 | 33.6 |
| Primigravida | 78 | 34.1 |
| Multiple Gestation | | |
| Single | 214 | 93.4 |
| Multiple | 15 | 6.6 |

Table 2b: Feto-maternal characteristic of the study participants (n = 229)

| Characteristics | Frequency (n) | Percentages (%) |
|---|---------------|-----------------|
| Prior pregnancy loss | | |
| Yes | 96 | 41.9 |
| No | 133 | 58.1 |
| Number of deliveries | | |
| None | 72 | 31.5 |
| 1-4 times | 118 | 51.5 |
| ≥5 times | 39 | 17.0 |
| Number of children delivered alive | | |
| 1-2 | 100 | 43.7 |
| 3-5 | 45 | 19.6 |
| >5 | 7 | 3.1 |
| None | 77 | 33.6 |
| Number of male children alive | | |
| 1-2 | 112 | 48.9 |
| 3-5 | 25 | 10.9 |
| None | 92 | 40.2 |
| Number of female children alive | | |
| 1-2 | 101 | 44.1 |
| 3-5 | 34 | 14.8 |
| None | 94 | 41.1 |

Table 3 Shows the maternal cultural and dietary/lifestyle practices of the participants. The dietary pattern and nutritional assessment of the participants revealed that 155 (67.7%) had more than three times meal served per day while 74 (32.3%) had less than three times per day. The majority of participants, 129 (56.3%), took Meat/fish/egg more than three times per week, 90 (39.3%) took 1 – 2 times per week, while 10 (4.3%) reported not taken it in a week. Among study participants, 118 (51.5%) took Vegetable/fruit three or more times per day, 97

(42.4%) took 1- 2 times per day while 14 (6.1%) did not take Vegetable/fruit per day in the index pregnancies. Most of the pregnant women, 125 (54.6%), did not report foods restriction during the index pregnancy, while 104 (45.4%) avoided different types of food during the index pregnancy. Only 1 (0.4%) reported cigarette smoking while the vast majority, 228 (99.6%), were non- smokers. The vast majority of the participants, 226 (98.3%), did not consume alcohol, while 3 (0.7%) took alcohol during the index pregnancy

Table 3: Maternal cultural, and dietary/life style practices (n = 229)

| Characteristics | Frequency (n) | Percentages (%) |
|---------------------------------------|---------------|-----------------|
| Meals served per day | | |
| 1-2 times | 74 | 32.3 |
| 3 or more times | 155 | 67.7 |
| Meat/fish/egg served per week | | |
| None | 10 | 4.4 |
| 1-2 times | 90 | 39.3 |
| 3 or more times | 129 | 56.3 |
| Vegetable/fruit served per day | | |
| None | 14 | 6.1 |
| 1-2 times | 97 | 42.4 |
| 3 or more times | 118 | 51.5 |

| | | |
|--|-----|------|
| Food items prohibited during pregnancy | | |
| Yes | 104 | 45.4 |
| No | 125 | 54.6 |
| Smoking | | |
| Yes | 1 | 0.4 |
| No | 228 | 99.6 |
| Alcohol | | |
| No | 3 | 1.3 |
| Yes | 226 | 98.7 |

Table 4 shows prevalence of anaemia in pregnancy. The overall prevalence of anaemia in this study was 31.9% and the mean PCV was 33.04 (SD± 6.774). This is presented in the table 5 below.

Table 4: Prevalence of anaemia in pregnancy (n= 229)

| CATEGORIES | FREQUENCY | PERCENTAGE |
|-------------|-----------|------------|
| ANAEMIC | 73 | 31.9% |
| NON ANAEMIC | 156 | 68.1% |
| TOTAL | 229 | 100% |

About two-thirds of anaemic participants, 48 (66.0%), had mild anaemia, followed by moderate 20 (27%) and severe anaemia 5 (7%), as illustrated in figure 1. Based on red blood cell morphologic classification of anaemia, of the total anaemic pregnant mothers, 60 (82%) had microcytic anaemia, 12 (17%) had normocytic, and 1% had macrocytic anaemia. This is presented in figure 2 below.

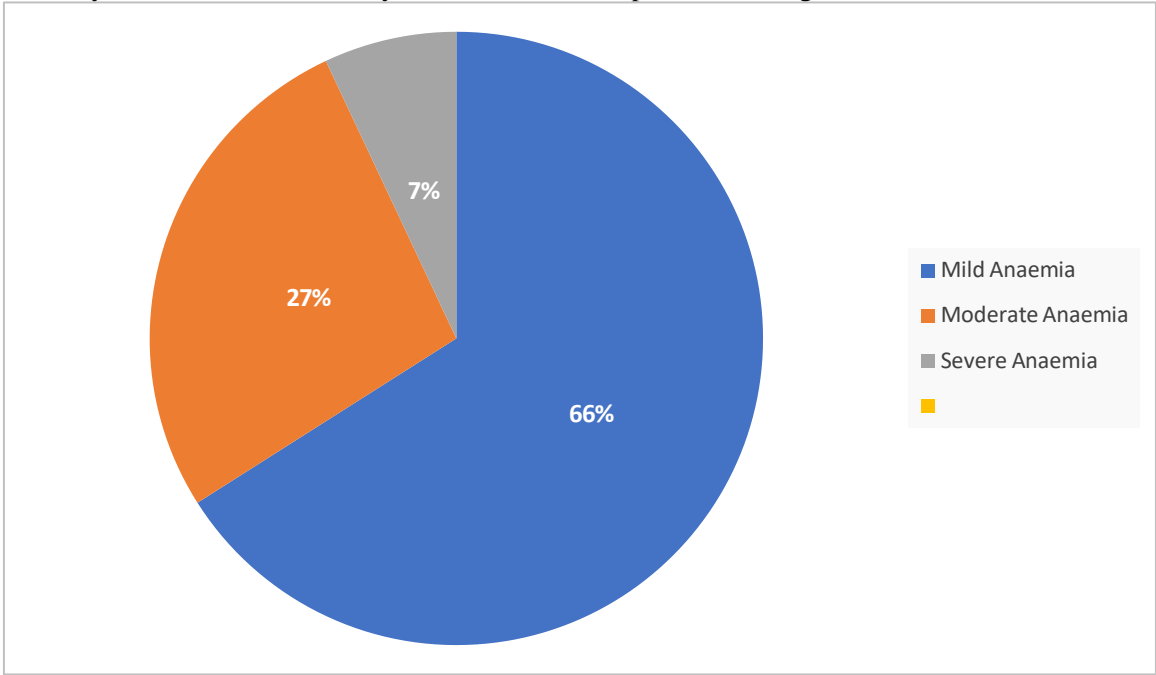


Figure 1: Pie chart showing the severity pattern of anaemia among the participants (n = 229)

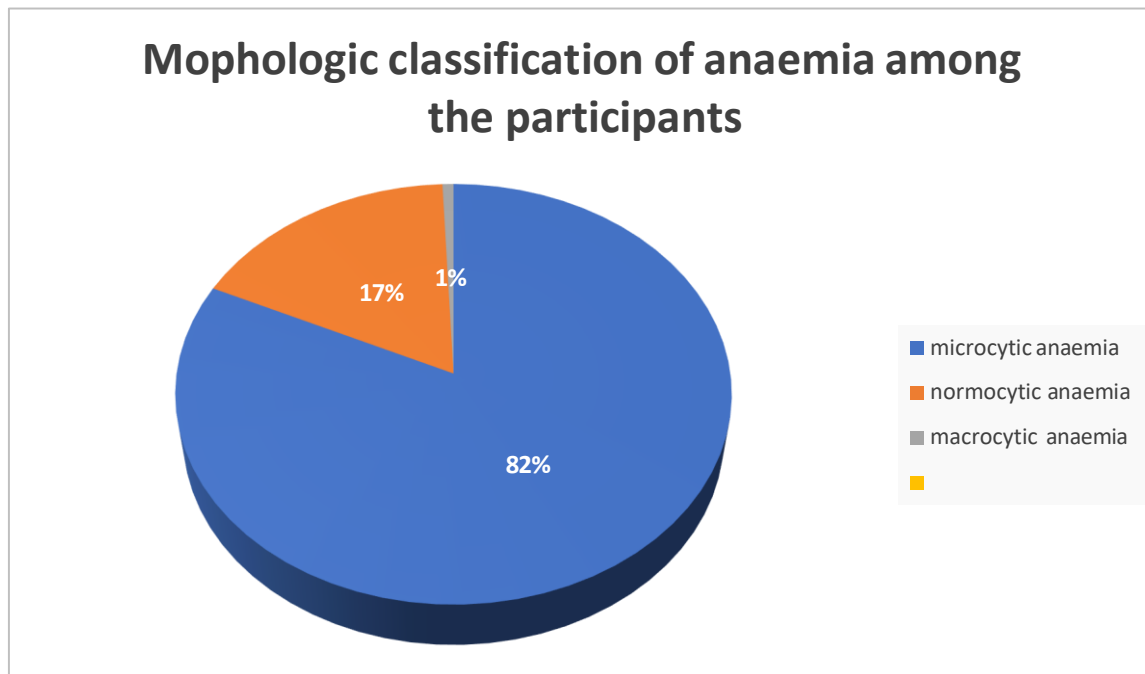


Figure 2: Pie chart showing the morphologic classification of anaemia among the participants (n = 229)

DISCUSSION

In this study, data from 229 participants were analysed. The ages of the participants ranged from 18 to 49 years. The mean age was 29.17 (SD± 6.133) years.

The prevalence of anaemia among pregnant women in this study was 31.9%. According to the WHO stratification of the public health importance of anaemia, this prevalence indicates a moderate public health significance of anaemia among pregnant women in this study.¹ This prevalence of anaemia is higher than, 17% reported in previous studies conducted in Kano 11 years ago by Nwizu *et al*¹⁴ and 12.3% reported by Ajape *et al* in Lagos, South-West Nigeria.¹⁶ The increase in prevalence observed in these studies might be due to worsening socioeconomic conditions in the last decade, likewise food insecurity caused by criminal activities in northern, Nigeria. However, this result is lower than 38 % reported by Victor *et al* in Warri and 45% reported by Idi *et al* in Yobe, North-eastern Nigeria.^{17,18} The difference observed in this study and the one by Victor *et al* in Warri and Idi *et al*.

in Yobe, North-eastern Nigeria, may be attributed to militancy and insurgency and its adverse effects such as poverty and malnutrition. However, this rate is similar to the prevalence of 31.66% reported from a cross-sectional study by Bekele *et al* in Ethiopia¹⁹ and 33% reported by Kofie *et al* in Ghana.²⁰ The similarities in the prevalence of anaemia in this study and that of Ghana and Ethiopia are not surprising because both are developing countries located in Africa continent with similar patterns of disease burden and socio-economic indices like our study.

This prevalence is lower compared to figures obtained in some other African countries such as Sierra Leone, 59.7%, and 63.1% in Burkina Faso.^{21,22} This might be because Nigeria has better gross domestic product GDP and good health care facilities compared to these countries. The result of this study is lower than the global prevalence rate of 41.8% % for anaemia in pregnancy.⁸ This might be due to the fact that majority of the participants in this study are urban dwellers with better socioeconomic status.

The severity pattern of anaemia noted in this study ranges from mild 66.0%, followed by moderate 27% and severe anaemia 7%. This finding better than a survey by Kefiyalew *et al* in South-east Ethiopia, who reported that, of the anaemic pregnant women, 55%, 32.5% and 12.5% had mild, moderate and severe anaemia, respectively.²³ This could be as a result of the fact that pregnant women on Iron supplementation and antimalarial prophylaxis were excluded from the study by Kefiyalew *et al*.²³ This might possibly alter the severity pattern of anaemia among the pregnant women in Kefiyalew's study compared to this study.²³

In this study, the majority of the pregnant women with anaemia 82% had a microcytic red blood cell morphology, with 17% having normocytic and only 1% with macrocytic morphology. This contrast with the findings of a study by Bekele *et al* and Mortaz *et al*,^{19,24} They reported that 97% of anaemic mother had normocytic red cells but in agreement with WHO finding, who reported that the majority of the pregnant mothers had microcytic anaemia.¹ The alteration in

morphological pattern reported by Mortaz *et al* might be due to the impact of haemodilution of pregnancy in the presence of low pre-pregnancy haemoglobin.²⁴ Furthermore, a high therapeutic drive with regard to a community with a high prenatal intake of Iron supplement in that study population by Mortaz *et al* may perhaps have contributed to this modified blood picture.²⁴

Limitation: The hospital-based design of this study may not permit generalization of the findings to the community compared to the community-based research. Thus generalization should be made with caution.

Conclusion: Anaemia is a public health problem that affects populations in both developed and developing countries. This study reported a high prevalence of anaemia among pregnant women accessing antenatal care at Aminu Kano Teaching Hospital, Kano. Thus, this high prevalence is a cause of major concern. Large scale community based studies should be done to assess the related factors for anaemia among pregnant women attending ANC.

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RANDOMISED CONTROLLED-TRIAL COMPARING NO-MESH GATHERING PLICATION REPAIR OF THE POSTERIOR WALL WITH THE REDUNDANT HERNIA SAC WITH MESH HERNIOPLASTY FOR INGUINAL HERNIA.**Ningi A.B, Abdulkadir I.**

Department of Surgery Abubakar Tafawa Balewa University Teaching Hospital, Bauchi-Nigeria.

Correspondence: Ningi A.B: (abningi@yahoo.com)**ABSTRACT**

Background: The gold standard for hernia repair has remained a tension free, permanent, simple to perform and safe repair. The absolute achievement of this has remained elusive. For a long time, the Mesh hernioplasty was considered the closest to this standard and was adopted by the European Hernia Society as the procedure of choice. The prosthetic Mesh, mostly polypropylene mesh, has many inherent drawbacks. It is costly, mostly non-available in poor countries, carries the risk of mesh displacement and hernia repair failure, and is associated with high risk of mesh infection that will require subsequent removal. The inguinal hernia fortunately present with a peritoneal sac. The sac is often large, toughened by repeated frictional injury, biological, and can be mobilised to strengthen the posterior wall. This will provide a secure, tension free, safe and simple method of repairing the weak posterior wall of the inguinal canal with a purely biological tissue. This novel repair will solve the problem of early recurrence associated with tension repair and provide a cheap method of repair that is equivalent in its advantages to the prosthetic mesh gold standard. **Aim of the study:** to demonstrate that a gathering plication repair of the weak posterior wall with the redundant sac gives a slightly superior outcome compared to the use of a prosthetic mesh. **Patients and methods:** The study is a prospective, randomised clinical trial. Both elective and acute cases of inguinal hernias admitted for surgery within the period of January 2021 and December 2021 were recruited. All patients 16 years of age and above and consented were recruited. All patients with poor immune status, on cytotoxic chemotherapy, with bleeding diathesis and those with ECOG/WHO stage 4 performance status and those who declined consent for surgery were excluded. **Results:** From our evaluation of the short-term and medium-term outcomes, such as surgery duration, immediate post-operative pain, ability to achieve normal gait, early return to work and early recurrence; peritoneal sac gathering plication technique is effective and safe, with the least post-operative complications compared to Lichtenstein Inguinal Hernia repair. **Conclusion:** Peritoneal sac gathering plication repair is simple, faster, and causes less post-operative pain without needing mesh. It is cost-effective and has a similar early recurrence rate to the Lichtenstein method. This technique may be a better option for younger patients due to a potentially lower risk of post-operative sexual dysfunction and subfertility

Keywords: Randomised trial, Peritoneal sac gathering plication repair, Lichtenstein repair.

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INTRODUCTION

The lifetime risk of developing an Inguinal Hernia is 27% for the male and 3% for the female globally.¹ About 800,000 repairs for the inguinal hernia is done in the United States of America annually. Globally, it is estimated that 1 in every 4 Males and 1 in every 50 females will potentially develop an inguinal hernia.² Unfortunately, some will present with a giant type of the hernia, which extends down to the level of the mid-thigh when the patient assumes an erect posture.³

The repair of a giant inguinal hernia is challenging, fraught with risk of abdominal compartment syndrome because, the content of the hernia has almost lost its right of domain in the abdominal cavity. The repair also fails often, because the weak posterior wall is often brought under tension. Where a prosthetic mesh is deployed for the repair, a larger size of at least 30 inches is required. The average cost is twenty-five to forty thousand naira (25,000-40,000) for a single mesh.

The use of the redundant sac as a biological mesh for the reconstruction of the posterior wall will solve the problem of the exorbitant price of the prosthetic mesh and its notorious non-availability in rural hospitals.

PATIENTS AND METHODS

The study was a prospective, single-centre, clinical trial. Both elective and acute cases of giant inguinal hernias admitted for surgery during the period of 1st January 2021 to 31st December 2021 were recruited. All patients 16 years of age and above (15 years and below is the cut off age for Paediatrics for the hospital) who consented/accented to the study were recruited. All patients with poor immune status, on cytotoxic chemotherapy, with bleeding diathesis and those with ECOG/WHO stage 4 performance status and those who declined consent for surgery were excluded. Informed consent was obtained according to the Helsinki guidelines and Ethical clearance was acquired from the Ethics and Research committees of the centre (*Approval reference withheld by the authors*). The study was conducted over a period of one year at the

General surgery unit of the Abubakar Tafawa Balewa University Teaching Hospital Bauchi-Bauchi State. Patients with primary inguinal hernias were randomly allocated intraoperatively to undergo The Peritoneal Sac gathering plication repair or A Lichtenstein mesh Hernioplasty through balloting. The sample size was determined by the duration as this is a cross sectional study. Each patient is allocated to either of the procedures through balloting. The surgeries were conducted by Consultants and Senior registrars in general surgery under regional or general anaesthesia, depending on the presentation and the duration of the hernia. Regional anaesthesia was used for long standing uncomplicated inguinal hernia because, of the possibility of incarceration from adhesions. All complicated cases were treated using general anaesthesia. With patients in supine position, routine cleaning and draping was done, exposing only the operative area. An 8-10 cm oblique groin incision was used for each procedure and surgical steps taken through the subcutaneous tissue and external oblique aponeurosis were done as in standard textbooks. The External Oblique Aponeurosis (EOA) was opened from the upper crux of the superficial ring to expose the arching fibres of the internal oblique muscle, which were retracted laterally to reach the spermatic cord. The cord dissection to separate the sac was done with a non-toothed dissecting forceps and the sac was isolated. The content of the sac was reduced in to the peritoneal cavity. The sac was opened at its fundus and any incarcerated enterocoele or omentocoele released. The sac was twisted, and a transfixing ligature was applied through the twisted segment. The redundant sac was not excised but, a gathering plication was done thrice to produce a thick cord. The lateral part of this thickened peritoneal cord was sutured to the medial shelf of the inguinal ligament from the pubic tubercle to the deep inguinal ring using Polyamide number 1 round body with continuous sutures. The first two sutures were taken from the anterior rectus sheath where the EOA interdigitate with it; the last suture was taken with the aim of narrowing the internal ring without constricting the spermatic cord. Each suture was passed first through the inguinal ligament, then the transversalis fascia and the thickened cord. The index finger of the left hand was used to

protect the femoral vessels and Collingwood Stewart hernia ring was used to retract the cord structures laterally while taking lateral sutures. the conjoined tendon lying close to it with Polyamide number 1 with continuous sutures throughout its length. The aponeurotic portion of the internal oblique muscle was used for suturing to the thick plicated sac to ensure a tension free suturing. The newly created strip was placed behind the cord to form a new posterior wall of the inguinal canal. Each patient was asked to cough to demonstrate the increased tension on the strip exerted by the external oblique muscle, for those given a regional anaesthesia. This increased tension exerted by the external oblique muscle is the bedrock of this repair. The spermatic cord was placed in the inguinal canal and the lateral leaf of the EOA sutured to the medial leaf of the EOA in front of the cord again using Polyamide number 1 sutures. This was followed by closure of the superficial fascia and the skin as usual.

The Lichtenstein Repair was performed as described in standard surgical textbooks.

Pain was measured using the visual analogue scale (VAS), with 0-30 mm signifying mild pain, 31-60 mm moderate pain, 61-90 severe pain and 91-100 excruciating pain.

RESULTS

A total of fifty (50) subjects were recruited. Males constituted 88%, females 12%, giving a male to female ratio of 7:1. The mean age was 42 years (± 2.98) and the age range was 18-75 years. A total of 54% presented with right sided inguinal hernia, 42%, had left sided inguinal hernia and the remaining 4% had bilateral inguinal hernia. Sixty percent of the patients had an indirect inguinal hernia with a dilated deep ring, 25% had a direct hernia, 12% had an indirect hernia with an intact deep ring, 3% had a pantaloon hernia and none had a femoral hernia. More than half of the patients (59%) were operated under spinal anaesthesia, 40% via local infiltration and one (1) patient was operated on using general anaesthesia. Twenty-five subjects (50%), had the No-Mesh Peritoneal Sac Plication repair while the remaining 25(50%) had the Lichtenstein-

The medial border of the plicated sac was sutured -

mesh hernia repair . 95% of the subjects had their surgery in less than 1 hour(20-45 minutes) while 5% had it for over an hour. Postoperative pain according to VAS (Mean \pm SD) on day 1 was 31.2 (± 02.0). Up to 68% of the subjects, experience mild to moderate post - operative pain, only 4% experienced severe pain. The severe pain was associated with the Lichtenstein Repair. There was no intra-operative complications in 94% of the subjects. Only 6% of the patients from each of the study groups had developed Seroma and Haematoma respectively, and only 4% from each developed Surgical Site Infection. Both Seroma and Haematoma formation were more associated with the No-Mesh Plication repair than the Lichtenstein repair. Sixty six percent (66%) of the cases were done as Day Care Surgeries, 36% were discharged within 48 hours and only 6% stayed on admission for more than 48 hours. All the patients that stayed for more than 48 hours had the Lichtenstein hernia repair. Majority of the patients (60%) achieved normal gait within 12 - 24 hours after surgery and returned to work within the first week of the surgery, 28% within 2-3 weeks, only 12% took more than 3 weeks to resume normal work. Up to 83.3% of those who took more than 3 weeks to return to work are the patients with post-operative complications like seroma, haematoma or surgical site infection (SSI). The degree of posterior wall weakness and dilatation of the deep ring increases with age. The weaker the posterior wall, the more dilated the deep ring, also the longer the duration of surgery. Most surgeries that lasted for an hour or above are also those with weaker posterior wall. This relationship also translates into more postoperative complications, irrespective of the type of the procedure done. No recurrence was recorded during the short period of the study.

DISCUSSION

Inguinal hernia remains a prevalent condition in Africa, with an increasing demand for surgical repair. In many tertiary, secondary, and even primary health centers, hernia repair is now frequently performed as a day-case procedure to

manage this high burden.⁴ However, the exact reason for the high prevalence of inguinal hernias among African men remains uncertain. Some studies from East Africa suggest an anatomical predisposition, particularly the low pubic arch, which weakens the pelvic myopectineal fascial system, increasing susceptibility to hernia formation.⁵

The ideal hernia repair should be tension-free, easy to perform, secure, safe, and cost-effective.⁶ The Lichtenstein mesh repair, regarded as the gold standard, and has been widely adopted due to its low recurrence rates. However, its use comes with significant drawbacks, including high costs, unavailability in rural settings, mesh migration, infection, and a higher incidence of chronic postoperative pain and mesh-related infertility.⁷ Consequently, there has been a growing interest in alternative, no-mesh techniques such as Desarda's repair, which utilizes the external oblique aponeurosis to reinforce the posterior wall. Studies have shown that Desarda repair provides outcomes comparable to Lichtenstein in terms of recurrence rates while reducing complications such as chronic pain and foreign body sensation.⁸

Our study further supports the viability of a no-mesh repair. In a randomized controlled trial comparing peritoneal sac gathering plication repair with Lichtenstein mesh repair, we observed that both techniques had similar short-term outcomes regarding recurrence rates. However, the peritoneal sac plication repair demonstrated several advantages. The operative time was shorter in most cases, with 95% of procedures completed within 45 minutes. Postoperative pain scores were generally lower, with 68% of patients experiencing only mild to moderate pain and severe pain being exclusively associated with Lichtenstein repair. Similar findings have been reported in global studies comparing no-mesh techniques to Lichtenstein, where no-mesh repairs resulted in lower postoperative pain and faster recovery.^{9,10}

Additionally, our study found that peritoneal sac plication repair was more commonly associated with seroma and hematoma formation than Lichtenstein repair, although both complications

were minor and self-limiting. Similar trends have been reported in previous studies, where no-mesh repairs occasionally resulted in higher seroma rates due to tissue rearrangement, yet did not translate into increased recurrence risk.¹¹

Regarding hospitalization and recovery, 66% of patients in our study underwent day-case surgery, and those requiring admission were primarily Lichtenstein repair recipients. Moreover, 60% of our patients resumed work within a week, and those who took longer than three weeks to return were primarily those with postoperative complications. These findings align with international studies reporting faster recovery and return to daily activities with no-mesh techniques compared to mesh-based repairs.¹²

Another significant finding in this study was the correlation between the degree of posterior wall weakness and operative duration. Patients with a weaker posterior wall tended to have longer surgery times and higher postoperative complication rates, regardless of the technique used. This observation reinforces the importance of selecting an appropriate repair method based on the patient's hernia characteristics.

Although this study was limited by a short follow-up period, the absence of recurrence within the study timeframe is promising. Given the advantages observed, peritoneal sac gathering plication repair presents a viable alternative to mesh repair, particularly in resource-limited settings. With further long-term studies, this biological mesh approach may redefine the gold standard for inguinal hernia repair in African populations.

CONCLUSION

This study demonstrates that peritoneal sac gathering plication repair is a viable alternative to Lichtenstein mesh repair, offering shorter operative time, reduced postoperative pain, and faster recovery. Although it was associated with slightly higher rates of seroma and hematoma formation, these complications were self-limiting and did not lead to increased recurrence within the study period. The findings suggest that this technique may be particularly beneficial in resource-limited settings where mesh availability

is a challenge. Further long-term studies are needed to establish its durability and effectiveness in reducing recurrence rates.

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