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THE EFFECT OF POSTNATAL CARE ON THE POSTPARTUM CONTRACEPTIVE USE IN ETHIOPIA: A SYSTEMATIC REVIEW AND META-ANALYSIS

Tesfalem Tilahun Yemane[1*], Mengestu Mera[2], Abebe Kassa[1], Nigusie Tadesse[1]

ABSTRACT

BACKGROUND: Effective postpartum contraception is crucial for maternal health and birth spacing. Postnatal care (PNC) visits represent a pivotal opportunity to encourage its use. Despite this, postpartum contraceptive uptake remains low in Ethiopia. Thus, this systematic review and meta-analysis seeks to evaluate the impact of postnatal visits on the utilization of postpartum contraception in Ethiopia.

METHODS: A systematic review and meta-analysis of published studies were conducted. Articles were systematically searched across multiple databases, including PubMed, HINARI, Science Direct, Cochrane Library, ETH Library, and Google Scholar. Data were analyzed using STATA 14 software. Publication bias was assessed using funnel plots and Egger's test. A random-effects model was employed to estimate the pooled prevalence of postpartum contraceptive use in Ethiopia.

RESULTS: The findings of the present systematic review and meta-analysis revealed that postnatal care visits significantly increase the utilization of postpartum contraception [pooled effect size 2.92 (95% CI, 2.21, 3.881)]. Postnatal care can provide critical information and support to women during the postpartum period, including information about family planning and contraceptive options.

CONCLUSION: Postpartum contraception is pivotal for maternal and child health. Postnatal care visits represent a crucial opportunity to promote its uptake. Healthcare providers can use these visits to educate women about contraceptive methods, discuss their advantages and potential risks, and help them choose the most suitable option for their needs.

PROSPERO Registration**:** CRD42020156574.

KEYWORDS: Postnatal care, postpartum contraceptive use, systematic review, meta-analysis, Ethiopia.

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INTRODUCTION

Postnatal care (PNC) encompasses essential healthcare provided to a woman and her newborn immediately after childbirth, extending up to six weeks (42 days) thereafter[1]. The World Health Organization (WHO) recommends a series of PNC visits: within the first 24 hours, at 48-72 hours, between days 7-14, and at 6 weeks postpartum[1]. Despite these guidelines, global PNC coverage stands at 59%, with a lower rate of 45% in sub-Saharan Africa[2]. In Ethiopia, only 34% of women received PNC within the first 2 days after delivery according to the 2019 Ethiopia Demographic and Health Survey (EDHS)[3].

Postpartum contraceptive use is critical for maternal and child health, enabling appropriate birth spacing, and reducing maternal and infant mortality[4-6]. The Ethiopian Ministry of Health and WHO recommend a minimum birth interval of 2 years to optimize maternal and child health outcomes[7,8]. Integration of family planning (FP) counseling during antenatal, immediate postpartum, and PNC services is crucial in achieving these goals[8,9].

Shorter birth intervals are associated with higher risks of adverse maternal and infant health outcomes, including premature delivery and infant mortality[7,10]. Postpartum family planning can significantly reduce these risks, with studies indicating potential reductions of 30% in maternal mortality and 10% in infant mortality[11].

Globally, over 90% of women desire to delay pregnancy for at least two years before giving birth[5,12]. Also, more than 60% of women in low- and middle-income countries have unmet needs for family planning services[13]. In sub-Saharan Africa (SSA), 20% of women give birth within two years after giving birth, and half of women have unmet needs for family planning services[13,14]. Thus, increasing access to effective postpartum contraception is vital to helping women achieve their reproductive intentions [5,13,14].

Despite global efforts, postpartum contraceptive use in Ethiopia remains low, with substantial unmet needs[9,15]. PNC visits present critical opportunities for counseling and provision of contraceptive methods[9,16-18]. However, the effectiveness of PNC in promoting postpartum contraceptive use requires further exploration. Therefore, this systematic review and meta-analysis aims to analyze and synthesize existing evidence on the impact of PNC services on postpartum family planning uptake in Ethiopia. This synthesis will inform policymakers and stakeholders involved in enhancing family planning services in Ethiopia.

METHOD AND MATERIALS

Study Design and Protocol Registration:

A systematic review and meta-analysis were conducted to quantify the pooled effect of PNC on postpartum contraceptive use. To report this systematic review and meta-analysis, an updated Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 statement was adapted[19]. The protocol has been registered on the International Prospective Register of Systematic Reviews, the University of York Center for Reviews and Dissemination. Available from: https://www.crd.york.ac.uk/prospero/display_record.php? (Registration ID number =CRD42020156574).

Search Strategies

A comprehensive search was conducted to identify relevant studies for this systematic review and meta-analysis. The following databases were used: PubMed, HINARI, ScienceDirect, Cochrane Library, ETH Library, and Google Scholar. The search strategy combined keywords and MeSH terms related to postnatal care, postpartum contraceptive use, and Ethiopia. Specific search terms included “postnatal care,” “postpartum contraception,” “family planning,” “maternal health,” “Ethiopia,” and their variations. Search strings were tailored for each database to ensure coverage of both indexed terms and free-text terms. Boolean operators (AND, OR) were used to combine search terms effectively. In the article search, the following keywords were used: “Postpartum family planning” OR “Postpartum contraceptive” AND Prevalence

OR utilization OR use AND determinants OR "Factors associated" OR predictors OR postnatal OR "postnatal care."

This systematic review and meta-analysis employed the PICO (Population, Intervention, Comparison, and Outcomes) framework to identify eligible studies. The study population (P) consisted of reproductive-age women (15-49 years) within their first 12 months postpartum; the intervention (I) was PNC follow-up; the comparison (C) group included women who did not receive PNC follow-up; and the outcomes (O) focused on the utilization of postpartum contraceptives within 12 months after delivery.

Criteria for Eligibility

Inclusion Criteria

The inclusion criteria for this review encompassed studies published in English that investigated the association between postnatal care visits and postpartum contraceptive use. Only studies conducted in Ethiopia were considered. Additionally, the review included studies published within the timeframe of January 30, 2013, to January 30, 2024.

Exclusion Criteria

Studies were excluded if they did not address the relationship between postnatal care and postpartum contraceptive use, were not conducted in Ethiopia, were not in English, or lacked accessible full texts. Additionally, studies that did not report PNC visits or their outcomes were excluded. Furthermore, review articles, conference proceedings, protocols, and grey literature were also excluded.

Study Selection

All articles identified in the search were imported into EndNote X7, where duplicate studies were removed. The initial screening of studies for inclusion was based on titles and abstracts. Full-text reviews were then conducted by two independent reviewers (TTY and AK). Potentially eligible articles were identified through this process. Any disagreements between the reviewers (TTY and AK) were resolved through discussion and, if necessary, with the involvement of an additional reviewer (NT). The overall selection process was summarized using the PRISMA flow diagram[19].

Quality Assessment of the Studies

Three reviewers (TTY, NT, and MM) independently assessed the quality of the included studies. A modified version of the Newcastle-Ottawa Scales was used to evaluate the quality of the studies[20]. The studies were divided into three categories: (0–4) low quality, (5–7) medium quality, and (8–10) high quality[21].

Data Extraction

All data were extracted by two independent reviewers (TTY and MM) using the JBI data extraction tool. Discrepancies were resolved through discussion, with a third reviewer (AK) involved as needed. For each included article, the following information was extracted: author(s), publication year, study area and region, study setting, study design, sample size, and adjusted odds ratio with confidence interval. The extracted data were first entered into a Microsoft Excel spreadsheet and then exported to STATA 14 software for analysis.

Data Analysis, Heterogeneity, and Publication Bias

Data analysis was conducted using STATA 14 software. Descriptive statistics summarized the characteristics of included studies. The pooled effect size was calculated using a random-effects model to accommodate study variability. Heterogeneity was assessed using the I^2 statistic and Cochran's Q test: I^2 values below 25% indicated low, 25–50% moderate, 51–75% substantial, and above 75% considerable heterogeneity, prompting subgroup and sensitivity analyses[22]. A significance level of $p < 0.05$ indicated heterogeneity.

Publication bias was evaluated through funnel plots, Egger's weighted regression, and Begg's rank correlation tests. Forest plots presented odds ratios with 95% confidence intervals (CI) for pooled effect sizes. Given heterogeneity, a random-effects model estimated pooled effects. Subgroup analyses explored variability sources based on region, publication year, study setting, and sample size. If publication bias was detected, the trim-and-fill method adjusted pooled estimates accordingly.

RESULT

STUDY SELECTION

A total of 1,208 articles were searched through electronic databases and grey literature. From these, 144 articles were excluded due to duplications, while the remaining 1,064 articles were reserved for further screening. Of these remaining articles, 776 and 221 were excluded by their titles and abstracts, respectively. A total of 67 full-text articles were assessed for eligibility criteria. Finally, 10 articles with appropriate quality were included in the final systematic review and meta-analysis. Furthermore, to summarise the selection procedure, the PRISMA flow diagram was used. (Fig 1)

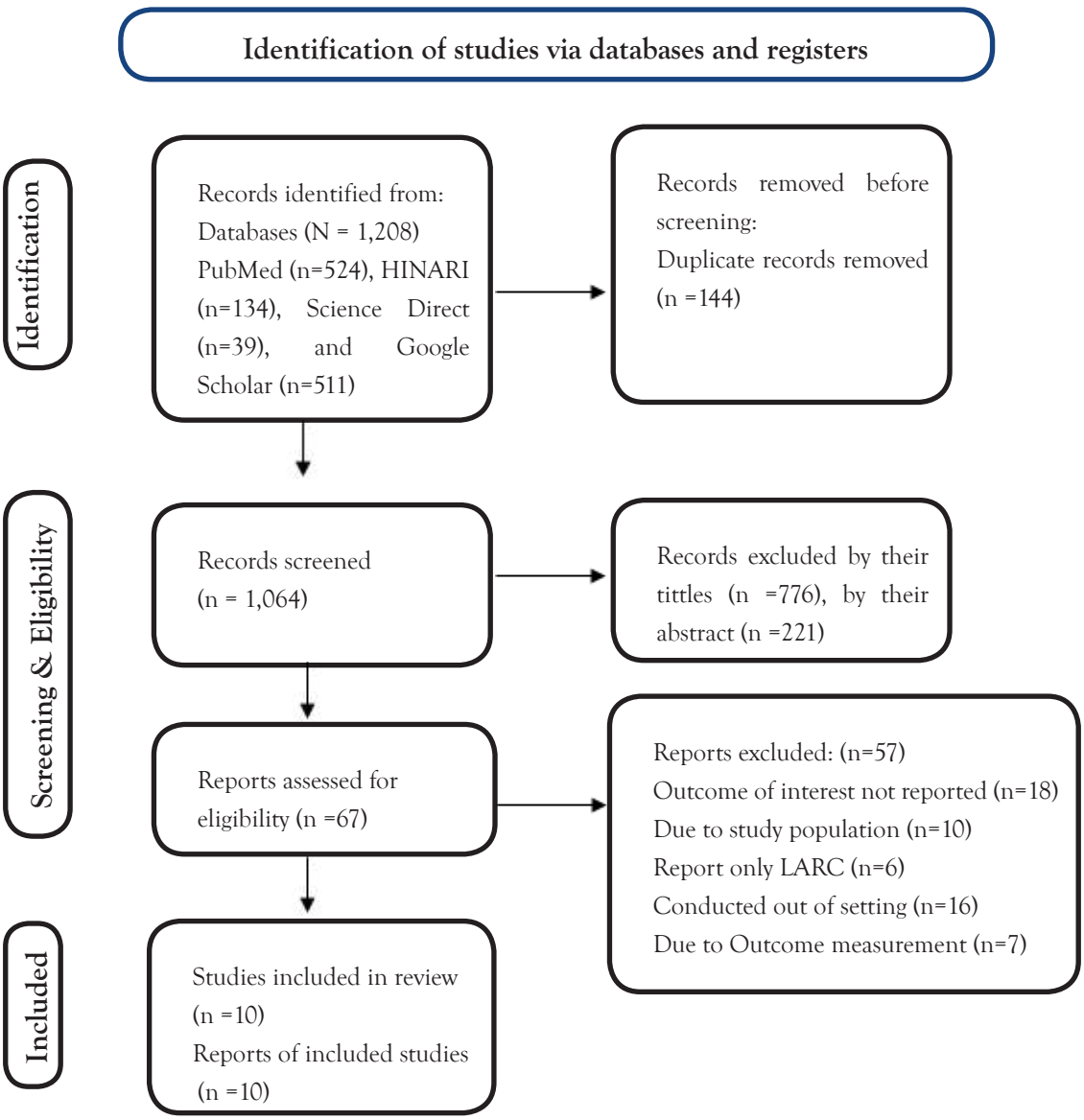

Figure 1.Description of schematic presentation of the PRISMA flow diagram to select and include studies, 2024.

CHARACTERISTICS OF INCLUDED STUDIES

As described in Table 1, these, 10 original articles were included in this systematic review and meta-analysis. The selected articles were published from 2016 to 2022. All included studies are cross-sectional in nature. In this study, 6157 postpartum women were involved. The sample size of the included studies ranged from 342[18] to 1109[17]. Out of 10 studies, six studies were conducted both in urban and rural settings[16, 23-27], three in urban[28-30], and one in rural[17] settings. The mean age of postpartum women ranged from 25.4[23] to 29.82 years[29]. The response rate of the included studies ranges from 95.6% [25] to 100% response rate[17,28]. Finally, regarding the quality score of the included studies, 7 of the 10 studies had high quality (8-10 points), and the remaining 3 studies had medium quality (5-7 points). Further descriptions and characteristics of the studies are included in Table 1.

Table 1: Descriptive summary of 10 studies included in the systematic review and meta-analysis of the effect of postnatal care on postpartum family planning use among women of the reproductive age group in Ethiopia, 2024.

Author	Publication Year	Region	Study Design	Sample size	Mean age of women's	Response Rate (%)	AOR ES (95% CI)	Quality score (10pt)
Abraha , et al.[17]	2018	Tigray	CBCS	1109	28.7	100	2.00 (1.33, 3.01)	7
Abraha T,et al.[16]	2017	Tigray	CBCS	590	27.4	98.2	2.36 (1.15, 4.86)	8
Asires, et al [30]	2017	Addis Ababa	IBCS	833	27.3	98.6	5.90 (1.70, 20.53)	8
Dona et al.[23]	2018	SNNP	CBCS	684	25.4	98.4	1.90 (1.23, 2.94)	8
Getachew , et al.[24]	2016	SNNP	CBCS	420	27.5	99.7	2.84 (1.44, 5.59)	7
Jaleta, et al.[25]	2019	Benishangul	CBCS	820	28	95.6	7.80 (3.96, 15.36)	8
Seifu, et al.[27]	2020	Oromia	CBCS	354	29.8	96.4	2.5 (1.3, 5.9)	8
Teka et al.[26]	2018	Oromia	CBCS	603	26.9	97.9	4.34 (2.37, 7.94)	7
Yimam, et al.[29]	2021	Afar	CBCS	342	29.82	97.8	2.54 (1.37, 4.68)	8
Mihretie, et al.[28]	2022	Amhara	CBCS	402	28.1	100	2.96 (1.57, 5.57)	8

Note: SNNP, Southern Nation Nationalities, and People regional state. AOR; Adjusted Odds Ratio. CBCS, Community based cross-sectional. IBCS, Institution based cross sectional.

PUBLICATION BIAS AND HETEROGENEITY

Publication bias was presented on traditional funnel plots. The shape of the traditional funnel plots indicates a symmetrical distribution (Figure 2). Moreover, to ascertain the funnel plot, Begg's and Egger's tests were conducted. Begg's and Egger's test results revealed the absence of statistically significant publication bias (p = 0.28 and p = 0.060, respectively). Statistical heterogeneity was checked by using the Cochran's-Q test and the I2 test and through visual examination of the forest plot (overlap of confidence intervals). In this analysis, moderate heterogeneity was observed across the included studies and detected by the Cochrane Q test (Q test p<0.001) and I2 statistics (I2 = 50.5%) (Figure 3). Because of this, a random effects model was used to estimate the effect of PNC follow-up on postpartum contraceptive use. By considering publication year, study setting, and sample size, sub-group analysis was performed to identify the possible source of heterogeneity, but none of these variables were found to be statistically significant (Table 2).

Table 2: Subgroup analysis for the effect of postnatal care on postpartum family planning use among women of the reproductive age (15-49 years) group in their first 12 months after delivery in Ethiopia, 2024 (n = 10).

Variable	Subgroup	Number of studies	Sample size	I2	ES (95% CI)
By Regions	Tigray	2	1,699	0.00%	2.08 (1.46, 2.97)
	Oromia	2	957	19.8%	3.46 2.03, 5.89)
	SNNP	2	1,104	0.00%	2.14 (1.48, 3.08)
	Others	4	2,397	57.4%	4.07 (2.31, 7.18)
By Sample size*	≥ 615	4	3,446	80.4 %	3.28 (1.68, 6.41)
	< 615	6	2,711	0.00 %	2.92 (2.23, 3.83)
By study setting	Both	6	3,471	64.2%	3.15 (2.05, 4.85)
	Urban	3	1,577	0.00%	2.98 (1.97, 4.51)
	Rural	1	1,109	-	2.00 (1.33, 3.01)
By publication year	<2020	7	5,059	66.7%	3.12 (2.09, 4.68)
	>=2020	3	1,098	0.00%	2.67 (1.83, 3.91)

Note: *Sample size for subgroup analysis categorized by taking the mean sample size

The vertical line indicates the effect size whereas the diagonal line indicates the precision of individual studies with a 95% confidence interval.

META-ANALYSIS

The effect of postnatal care follow-up on the utilization of postpartum modern contraceptives

As shown in the forest plot, the results of the 10 included studies indicated that the pooled effect size of postpartum modern contraceptive utilization among those mothers who had postnatal care visits was 2.92 (95% CI, 2.21, 3.88) compared to those mothers without having PNC visits in the random effects model (Figure 3). The findings of this systematic review and meta-analysis revealed that having postnatal care visits increases the utilization of postpartum modern contraceptives.

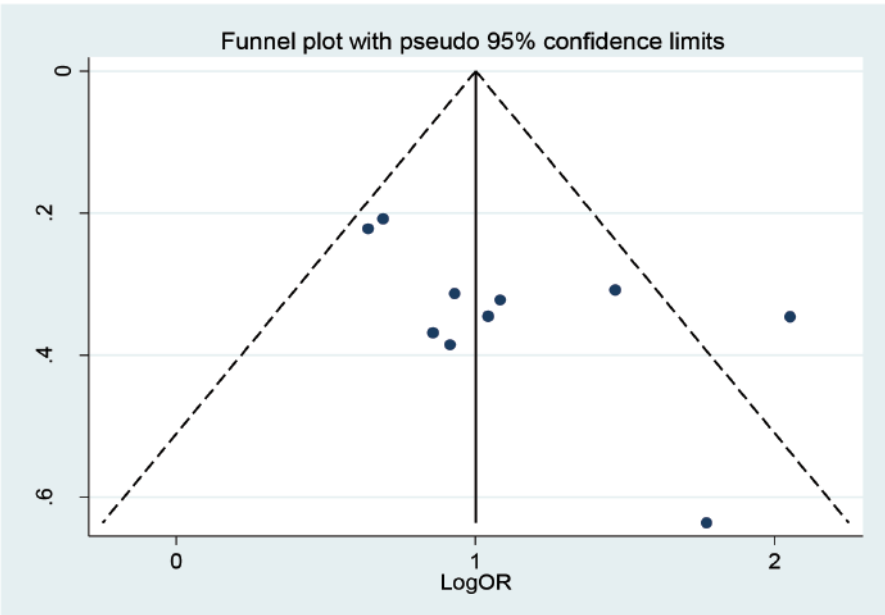

Figure 2: Funnel plot of the 10 included studies of the effect of PNC on utilization of postpartum contraceptives in Ethiopia, 2024.

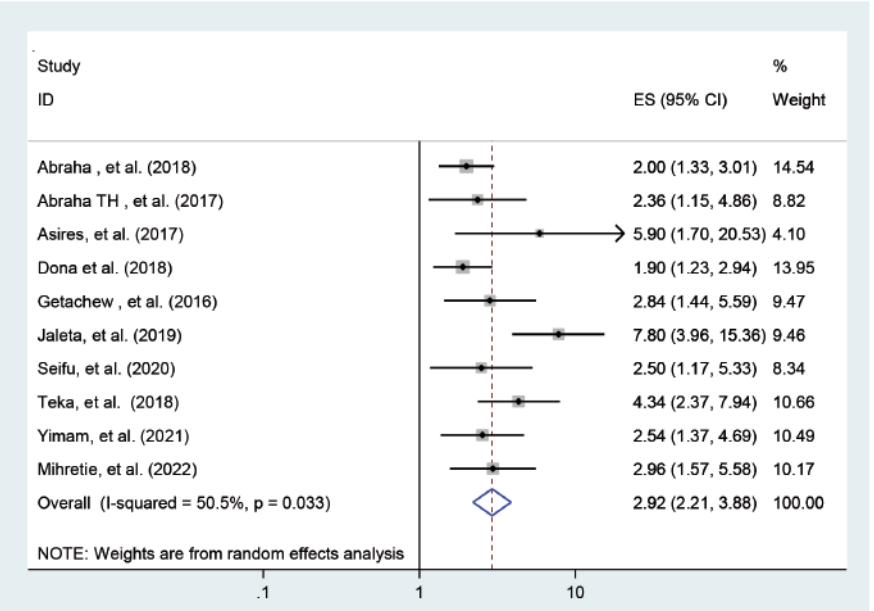

Figure 3: Forest plot of 10 included studies, which reveal the effect of PNC on utilization of postpartum contraceptive in Ethiopia, 2024.

SUBGROUP ANALYSIS

To decrease sizeable heterogeneity, subgroup analysis was performed based on the regions where the studies were conducted, the sample size of the studies, the study setting, and the year of publication. Based on subgroup analysis, the effect of postnatal care follow-up on utilization in the Tigray region was 2.08, 95% CI (1.46, 2.97), Southern Nation and Nationalities was 2.14, 95% CI (1.48, 3.08), and Oromia was 3.46, 95% CI (2.03, 5.89) (Table 2). With regard to sample size, the larger the sample size the more precise the effect size.

DISCUSSION

The findings of this systematic review and meta-analysis revealed that PNC follow-up has a significant effect on the utilization of postpartum contraceptives. The current meta-analysis reported that having postnatal care services was positively associated [2.92 (95% CI, 2.21, 3.88)] with the use of contraceptives during the postpartum period. This suggests that women who receive postnatal care are almost three times more likely to use contraceptives after giving birth compared to those who do not receive postnatal care.

This finding is consistent with USAID findings from 17 countries, a systematic review and meta-analysis conducted in low- and middle-income countries, and low-income countries in SSA[31-33]. Those findings suggest that the utilization of contraceptives among postpartum women will increase substantially if more women use postnatal care. Similarly, a systematic review in sub-Saharan Africa found that family planning counseling during antenatal care, delivery, and postnatal care significantly increased the uptake of modern contraceptives in the postpartum period[34]. The continuity of care during the postnatal period can foster trust in the healthcare system and providers, making women more likely to accept contraceptive services[9].

The possible explanation for this finding is that women might get the opportunity for contraceptive counseling and the benefits of birth spacing from health professionals during PNC follow-up. In addition, PNC provides an important opportunity for healthcare providers to deliver appropriate contraceptive methods. Furthermore, the WHO emphasizes the importance of incorporating family planning counseling into postnatal care services

to encourage healthy birth spacing and prevent unintended pregnancies[6].

The techniques for testing the publication bias of the included studies were considered. It was examined by performing Egger's correlation and Begg's regression intercept tests at a 5% significant level. The results of Begg's and Egger's tests indicated that there was no statistically significant publication bias across the included studies, as evidenced by p = 0.28 and p = 0.06 in Begg's and Egger's tests, respectively. In this meta-analysis, to identify the possible sources of heterogeneity, subgroup analysis was performed based on the regions and sample size. However, the result of the subgroup analysis indicated that the source of moderate heterogeneity was not because of the study regions or sample size.

CONCLUSIONS

Ultimately, the results of this systematic review and meta-analysis showed that women who receive postnatal care were more likely to use contraceptives after giving birth compared to those who do not receive postnatal care. Integrating family planning counselling and services into all maternal and child health (MCH) units could be an effective strategy to increase postpartum contraceptive use. Therefore, maximizing postnatal care visits helps to improve the utilization of postpartum contraceptives, as well as the outcome of maternal and child health. Thus, enhancing maternal continuum of care is an effective strategy to maximize both postnatal care and postpartum contraceptive utilization.

DECLARATIONS

Limitations of the Study

Only English articles were considered for this review. In addition, the majority of studies were obtained from the Oromia, Tigray, and SNNP regions. Therefore, the results may not be strongly representative of the other regions due to the small number of studies included.

Acknowledgement

Not applicable

Abbreviations

PNC; Postnatal Care.
MeSH; Medical Subject Headings.
AOR; Adjusted Odds Ratio.
PPFP; Postpartum Family Planning,
PRISMA; Preferred Reporting Items for Systematic Review and Meta-Analysis.
WHO; World Health Organization.

Data Availability

The authors declare that the data will be available upon reasonable request to the corresponding author.

Conflict OF Interest

The authors declared that we have no competing interests regarding the publication of this paper.

Funding Statement

No funding was obtained for this work.

Authors' contributions

All authors have contributed to this study. TTY contributed to the conception of the research protocol, protocol preparation and registration, study design, literature review, data extraction, data analysis, interpretation, and drafting of the manuscript. NT participated in a literature review, data extraction, and quality assessment. AK participated in the literature review, data extraction, and quality assessment. MM participated in a literature review, data extraction, and quality assessment. All authors read and approved the final manuscript.

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SUPPORTING INFORMATION

S1 Fig 1: Description of schematic presentation of the PRISMA 2020 flow diagram to select and include studies, 2024.

S2 Fig 2: Funnel plot of the 10 included studies of the effect of PNC on utilization of postpartum contraceptives in Ethiopia, 2024.

S2 Fig 3: Forest plot of 10 included studies, which reveal the effect of PNC on utilization of postpartum contraceptive in Ethiopia, 2024.

S1 Table 1: Descriptive summary of 10 included studies in the systematic review and meta-analysis of the effect of postnatal care on postpartum family planning use among women of the reproductive age group in Ethiopia, 2024.

S2 Table 2: Subgroup analysis for the effect of postnatal care on postpartum family planning use among women of the reproductive age (15-49 years) group in their first 12 months after delivery in Ethiopia, 2024 (n = 10).

GENETIC CAUSES OF PRIMARY AMENORRHEA USING CHROMOSOMAL ANALYSIS AND PCR FOR SRY GENE

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ABSTRACT

BACKGROUND: Primary amenorrhea is defined as the absence of menstruation by age 14 without secondary sexual characteristics or by age 16, regardless of normal development. Chromosomal aberrations account for 14-60% of cases. This study aimed to evaluate chromosomal abnormalities in patients with primary amenorrhea referred to Elite Genetics Center, Khartoum-Sudan, for genetic analysis.

METHODS: Between 2017 and 2023, 248 patients with PA were investigated. Clinical data, hormonal profiles, and sonographic findings were recorded. Karyotyping was done initially, and PCR analysis for the SRY gene was used as a complementary test for patients with normal karyotypes. The clinical diagnosis was based on the history, clinical presentation, hormonal investigation, sonographic findings, and cytogenetic and molecular results.

RESULTS: The results showed that 68 (27.4%) had female karyotypes (46,XX), and 36 (14.5%) had male karyotypes. Numerical chromosomal abnormalities were seen in 97 (39.1%) cases, structural changes in 14 (5.6%), and mosaic abnormalities in 33 (13.3%). Turner syndrome was present in 137 (55.2%), Trisomy X (47, XXX) in 3 (1.2%) cases, and sex reversal (46, XY) in 7 (2.8%) cases. Clinical diagnosis included XY DSD in 21 (8.5%), Complete Androgen Insensitivity Syndrome in 8 (3.2%), Swyer's syndrome in 7 (2.8%), Ovotesticular DSD in 4 (1.6%), Mayer-Rokitansky-Küster-Hauser syndrome in 5 (2%), and Triple X in 3 (1.2%) cases.

CONCLUSION: The results highlight the need for cytogenetic analysis as an integral part of the PA diagnostic protocol. Complementary PCR for the SRY gene is essential in differentiating XY DSD cases.

KEYWORDS: Primary amenorrhea, Chromosomal abnormalities, Karyotyping, Cytogenetic study

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INTRODUCTION

Primary amenorrhea (PA) is a common gynecological problem in adolescent girls. Normal menstruation depends on the structural and functional integrity of the female genital tract, ovaries, pituitary gland, and hypothalamus.[1] Chromosomal abnormalities, hormonal disorders, endometritis, gonadal failure, and Mullerian dysgenesis can cause PA, defined as the failure of a female with normal secondary sexual characteristics to menstruate by age 16 or a female without secondary sexual characteristics by age 14.[2] PA is the sixth leading cause of female infertility, with an infertility rate of 15% worldwide.[3] The prevalence of PA among women of childbearing age is about 2–5%[4,5]

Chromosomal abnormalities remain the primary cause of PA, occurring in 1 per 1000 live births and ranging between 10% to 25% of patients with PA.[6] The SRY gene, located on the short arm of the Y chromosome at Yp11.31, encodes a 204 amino acid protein vital for initiating male sexual differentiation. SRY gene mutations, due to abnormal X/Y crossover, lead to sex reversal and PA.[7,8] Therefore, PCR testing of the SRY gene is crucial in the genetic assessment of PA patients with normal karyotypes.

Different types of sex chromosome changes contribute to PA, making cytogenetic investigation essential for etiological diagnosis, risk assessment, and genetic counseling.[9,10] This study, the largest of its kind, aimed to determine the frequency and types of chromosomal abnormalities associated with primary amenorrhea in Sudanese female patients.

METHOD AND MATERIALS

Patients for Cytogenetic Analyses A total of 248 female patients, all with primary amenorrhea, were referred to Elite Genetic Center for cytogenetic and molecular analysis between 2017-2023 and were enrolled in a retrospective cross-sectional study. The diagnosis of primary amenorrhea was confirmed, and only those aged 14 years and older with the absence of secondary sexual characteristics or 16 years and older with secondary sexual characteristics were included.

Patients for SRY Gene Molecular Study As a complementary investigation, polymerase chain reaction (PCR) was performed in 108 patients with normal karyotypes (XX or XY).

Sampling Around 5ml of venous blood was collected from each patient under complete aseptic conditions. Instantly, 3 ml were placed in a sodium heparin vacutainer for cytogenetic analyses, and 2ml were placed in an EDTA tube for later genomic DNA extraction and SRY gene molecular analyses when necessary.

Methods Cytogenetic Analyses All samples were processed for cytogenetic analyses as described earlier[9]. In brief, cultures were set by adding 10-15 drops of blood to 10 ml of McCoy's 5A Modified Media (Sigma®), supplemented with L-glutamine, penicillin (100 IU/mL), streptomycin (200 µg/mL), 25% fetal bovine serum (Sigma®), and 3.4 mL phytohemagglutinin (10 µg/mL) (Sigma®). The specimens were incubated in a 5% CO2 incubator at 37 ° C for 72 hours.

The harvesting started after 72 hours by adding 100 µg/ml Colcemid (10 µl/ml) (Sigma®) for 30 minutes to arrest the cells (lymphocytes) in the metaphase stage. The cell suspension was exposed to hypotonic shock in 0.05 M KCl and then fixed three times in methanol: acetic acid (3:1). The cell suspension was centrifuged at 1300 rpm for 10 min before removing the supernatant and resuspending in approximately 0.5-1 ml of fresh fixative (3:1 methanol: acetic acid). Around 1-4 drops of cell suspension were placed on a clean, dry glass slide. The quality and spreading of chromosomes were assisted under a phase contrast microscope after 2-4 slides were prepared for each patient.

The slide-DNA-aging was obtained overnight by keeping the slide in the oven at 60 °C. The slides were immersed in a buffer solution (2XSSC) and kept in a water bath at 60 ° C for 2-3 hours. After that, the buffer solution was poured off, and the slides were washed repeatedly with running tap water and air-dried for 1 hour before staining.

G-banding was obtained using Wright's stain, and for each case, 5 to 25 metaphases were analyzed using the CytoVision system, Applied Imaging®. The clonality criteria and karyotypic descriptions were done according to the recommendations of the International System for Chromosomal Nomenclature (ISCN 2020)[10].

Molecular analysis for SRY gene

DNA was extracted from the patient's blood samples collected in EDTA containers using Wizard Genomic DNA Purification Kit Promega®. The DNA samples were kept at -20 °C until PCR analysis was performed. PCR amplification was performed using primers for the SRY gene (Table 1).

Table 1 shows the DNA primer sequence for the SRY gene and the temperature used for the DNA

Primer	DNA sequence(5`to3`)	Temperature (°C)
Forward	TACAGGCCATGCACAGAGAG	60
Reverse	TAAGTGGCCTAGCTGGTGCT	60

In brief, the SRY gene was PCR amplified for the DNA of the patients, as well as from the fertile XX female and fertile XY male controls. The PCR mixture of each sample consisted of 1.0 µL of genomic DNA, 0.2 µL (1.0 U) of Taq polymerase, 3.0 µL of each primer, 1.0 µL dNTPs, 1.5 µL MgCl2, 12.8 µL H2O, and 2.5 µL PCR buffer in a final volume of 25 µL. The PCR conditions were 5 min at 95 °C for preheating, 35 cycles of 94°C for 20 seconds (denature), 61°C for 45 seconds (annealing), and 72 °C for 1½ min (extension), and 72 °C for 5 min. Reaction products were electrophoresed on 1.5% agarose-TBE gels containing 0.5 µg/ml Ethidium bromide (for staining) and documented with gel electrophoresis. Hyper ladder 100 bp has been used as a marker.

The statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 20. Data were expressed as frequencies and percentages (%).

Ethical Considerations The ethical approval for the present study was obtained from the Ethical Committee at Al Neelain Stem Cell Research Center at Al Neelain University. The data were anonymized, and written consent from all patients or their parents was obtained before enrollment.

RESULTS

Of the 248 primary amenorrhea cases studied, the karyotype analysis showed that 68 (27.4%) of the cases revealed female karyotype complement (46,XX) consistent with their female sex, whereas 36 (14.5%) showed male karyotypes (46,XY). Of all cases, 144 (58.1%) showed abnormal karyotypes. Of these, numerical chromosomal abnormalities were seen in 97 (39.1%) cases, whereas structural chromosomal changes were seen in 14 (5.6%) cases (Table 2).

Table 2 shows the results of cytogenetic analyses of 248 patients referred to Elite Genetics Center with Primary Amenorrhea.

Cytogenetic category	Karyotype	Number (%)
Normal	46,XX 46,XY	68 (27.4%) 36 (14.5%)
Trisomy chromosome X	47,XXX	3 (1.2%)
Monosomy X	45,X 94 (37.9%)	
Structural abnormalities	46,X,del(X)(p10) 46,X,i(X)(q10)	8 (3.2%) 6 (2.4%)
Mosaic without numerical aberration	46,XX/46,XY	4 (1.6%)
Mosaic with numerical aberration	46,XX/45,X	17 (6.9%)
Mosaic with Structural abnormalities	46,XX/46,X,del(X)(p10) 46,XX/46,X,i(X)(q10) \45,X/46,X,i(X)(q10) 46,XX/46,X,del(X)(p10)/ 46,X,i(X)(q10)	4 (1.6%) 4 (1.6%) 1 (0.4%) 2 (0.8%)
Mosaic with numerical and Structural abnormalities	46,XX/45,X/46,X,i(X)(q10)	1 (0.4%)

Apart from cases with normal karyotype, changes involving chromosome X, the most common chromosome in this study, were seen in most cases. Of the 248 patients with PA, Turner syndrome was the most common cause of PA seen in 137 (55.2%), of which monosomy of chromosome X was seen in 94 (37.9%) (Figure 1), mosaic karyotype (46,XX/45,X) seen in 17(6.9%), del(Xp) seen in 8 (3.2%) (Figure2), i(Xq) seen in 6 (2.4%) of the cases (Figure 3), mosaic karyotype 46,XX/46,X,del(X)(p10) and 45,X/46,X,i(X)(q10) were seen in 4(1.6%) cases each, 46,XX/46,X,del(X)(p10)/ 46,X,i(X)(q10) seen in 2 (0.8%), both 45,X/46,X,i(X)(q10) and 46,XX/45,X/46,X,i(X)(q10) karyotypes were seen in 1 (0.4%) cases each. Trisomy of the X chromosome (47, XXX) was in 3(1.2%) cases, and sex reversal females (46, XY) were in 7(2.8%) cases (Figure 4). Trisomy of the X chromosome (47, XXX) was in 3(1.2%) cases, and sex reversal females (46, XY) were in 7(2.8%) cases (Figure 4).

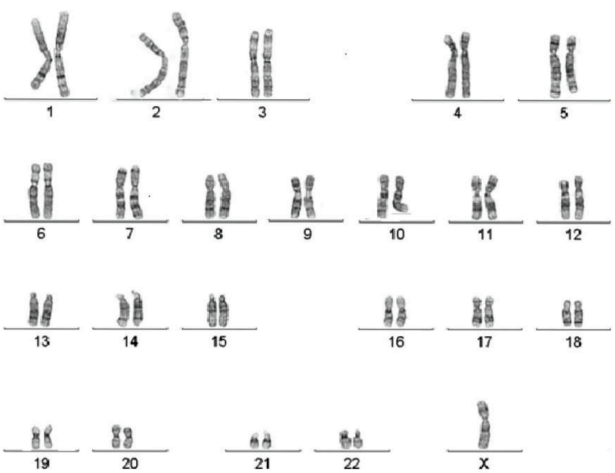

Figure 1. Karyotypic monosomy of the X chromosome (45,X) is consistent with the Turner syndrome diagnosis. The karyogram showed a loss of the second copy of chromosome X.

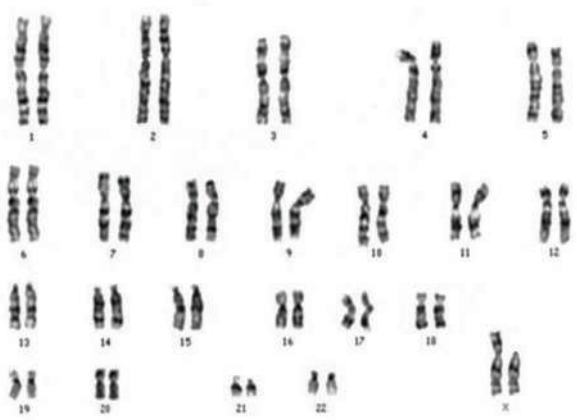

Figure 2. Shows loss of the p arm of the X chromosome. 46,X,del(X)(p10) karyotype consistent with the diagnosis of Turner's syndrome.

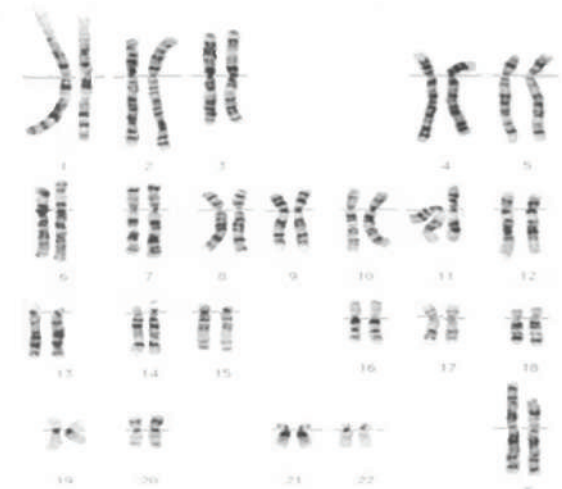

Figure 3. Shows an iso q arm of chromosome X. 46,X,i(X)(q10) karyotype consistent with the Turner syndrome diagnosis.

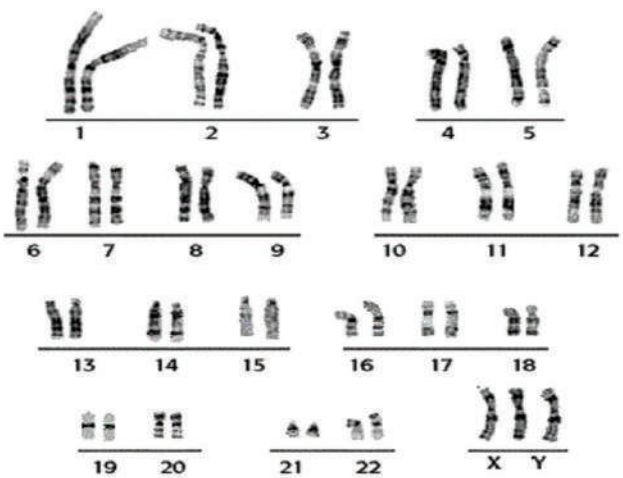

Figure 4. Shows extra copy of chromosome X. 47,XXX karyotype with trisomy X consistent with the diagnosis of Triple X syndrome.

As a complementary test, PCR for the SRY gene was performed in 108 patients with normal karyotypes (46,XX, 46,XY). Out of 108 cases, the SRY gene was detected in 33 cases (30.6%). Among them, 29 cases had a 46,XY karyotype, and 4 had a mosaic karyotype of 46,XX/46,XY. The remaining 75 (69.4%) cases showed negative SRY genes.

According to the clinical examination, imaging findings, hormonal, cytogenetic, and PCR for SRY gene results, 137 (55.2%) of the patients revealed a clinical diagnosis of Turner's syndrome, 21 (8.6%) XY-DSD, 8 (3.2%) Complete Androgen Insensitivity Syndrome (CAIS), 7 (2.8%) Swyer's syndrome, 4 (1.6%) Ovatesticular DSD, 5 (2%) Mayer-Rokitansky-Küster-Hauser (MRKH) syndrome, and 3 (1.2%) complete premature ovarian failure (Triple X syndrome) (Table 3).

Table 3 shows the clinical findings, genetic work-up, and provisional diagnoses of 248 patients with primary amenorrhea referred to Elite Genetics Center.

	Clinical findings		Genetic workup			
Provisional diagnosis	**Physical examination**	**Imaging**	**Hormone profile**	**karyotype**	**SRY gene**	**N (%)**
46,XX Gonadal dysgenesis	Underdeveloped secondary sexual characteristics, normal female genitalia	Hypoplastic uterus, streak ovaries	↑FSH and LH ↓ estrogen ↔ testosterone	46,XX	-ve	63 (25.4%)
XY-DSD	Underdeveloped breasts, Clitoromegaly, Undescended testes +/- Inguinal hernia	undescended testes	↔ FSH, LH and estrogen ↔↑testosterone ↓ DHEAS	46,XY	+ve	21 (8.6%)
CAIS	well-developed breast, normal external female genitalia	Absent uterus, undescended Testes	↔ FSH, LH and estrogen ↑ testosterone	46,XY	+ve	8 (3.2%)
Swyer's syndrome	Female phenotype, Clitoromegaly	Present Uterus and gonads.	↑FSH and LH ↓ estrogen ↔ testosterone	46,XY	-ve	7 (2.8%)
Ovotesticular DSD	Unilateral Palpable gonads, ± big phallus and vagina	Small uterus, intra-abdominal gonad	↔ FSH, LH and estrogen ↑ testosterone	46,XY/46,XX	+ve	4 (1.6%)
Mayer-Rokitansk –Küster- Hauser syndrome	Normal secondary sexual characteristics, normal external genitalia	Absence of uterus, cervix, and vagina, with normal Ovaries	↔ FSH, LH, estrogen and testosterone	46,XX	-ve	5 (2%)
Triple X syndrome	Tall, well-developed breast, normal femal genitalia	Normal uterus, cervix, vagina, and ovaries	↔ FSH, LH, estrogen	47,XXX		3 (1.2%)
Turner's syndrome	Short stature, Wide neck, short, low hairline, broad chest, underdeveloped breast with wide distance nipples, increased carrying angle, absence of secondary sexual characteristics, normal external female genitalia	Hypoplastic uterus, streak ovaries.	↑FSH and LH	45,X 46,X,del(X)(p10) 46,X,i(X)(q10) 46,XX/45,X 46,XX/46,X,del(X)(p10) 46,XX/46,X,i(X)(q10) 45,X/46,X,i(X)(q10) 46,XX/46,X,del(X)(p10)/ 46,X,i(X)(q10) 46,XX/45,X/ 46,X,i(X)(q10)		137(55.2%)
Total						**248**

DISCUSSION

Primary amenorrhea (PA) is a common gynecological disorder that indicates a potential future fertility issue. A normal karyotype and/or genome is necessary for normal female sexual development.[11] Worldwide, genomic alterations, including sex chromosomal abnormalities, are repeatedly reported as etiological causes of PA.[12,13] Many studies have investigated the frequency and types of chromosomal abnormalities in PA, but few have been conducted in Sudan. A previous survey in Sudan suggested that some physicians were hesitant to refer patients for genetic investigation, and many patients were unwilling to seek medical help or refused chromosomal analysis due to shame or cultural issues. As a result, our present study may not accurately reflect the true extent of the problem. The possibility of Muslim males entering into multiple marriages leads to female concerns about detecting potential genetic disorders that may affect female fertility and could justify having a second wife.[14]

Previous studies estimated the frequency of chromosomal abnormalities to range from 24% to 63%, with most falling between 20-30%.[15,16] This aligns with our results, which showed 58.1% abnormal numerical and/or structural karyotypes. However, the data showed an even higher percentage (70.1%) of abnormal genetic profiles, considering the molecular results of the SRY gene. The complementary molecular analysis in our study adds valuable information for the clinical diagnosis of cases with normal karyotypes, such as Swyer's syndrome and Androgen Insensitivity Syndrome (AIS). The elevated occurrence of abnormal karyotypes within our cases could potentially be attributed to the notably higher prevalence of Turner syndrome in our study, accounting for 55.2% of cases, compared to the average of 20% observed in most other studies.[17] The disparity in findings may be attributed to the predominant failure to diagnose Turner syndrome during childhood in our region, potentially resulting in a higher number of identified cases in our study. Furthermore, our research revealed a marked increase in the number of cases with disorders of sexual development compared to the findings of other studies.[18]

This study indicates the importance of including genetic workup for patients with PA, even in countries with limited health resources. The genetic workup can eventually help reveal the etiology of PA and assist in delivering proper genetic counseling for the potential infertility problem.[3]

Cytogenetic analysis showed loss of the p arm of chromosome X (45,X/46,X,i(Xq)/46,X,del(Xp)) in the vast majority (55.2%) of the cases being the most common genetic disorder foreseen in the phenotype diagnosis. Such karyotypic abnormalities are mainly due to initial X chromosome breakage and fusion, leading to unipolar segregation.[16] Turner syndrome is the most common disease, occurring in approximately one in 1500 newborn female infants. Endocrine, cardiac autoimmune, and other structural complications pose considerable risks.[19] Identifying these patients as early as possible may allow them to benefit from a variety of existing fertility preservation options and pre-puberty hormonal therapy to overcome their short stature.[20]

Eight patients (3.2%) showed male karyotypes (46,XY) despite their female phenotype. Such patients need further investigation, including ultrasonography and PCR analysis, to assess the integrity of the SRY gene and other genes in the testes determining pathway. Patients with female phenotype and male karyotypes (positive SRY gene) are clinically known as Androgen Insensitivity Syndrome (AIS). Usually, they represent a significant counseling challenge for treating physicians if they present complaining of failure to conceive after getting married. In a society like Sudan, counseling is even more difficult for the couple and their families. Moreover, such patients are also at high risk of testicular tumors due to the undescended testicles; thus, surgical interventions (bilateral orchiectomy) aiming to reduce this risk are recommended.[21]

Triple X syndrome is characterized by the presence of an extra X chromosome. It may show non-mosaic karyotypes in most cases. Mosaicism cases are seen in 10% of cases with variable combinations such

as 46,XX/47,XXX or 47,XXX/48,XXXX, and rarely in combinations with karyotypes consistent with Turner syndrome cell lines (45,X/47,XXX; 45,X/46,XX/47,XXX). The phenotypes of this syndrome are variable, including primary or secondary amenorrhea, late menarche, and menstrual irregularities.[22]

In this study, 7 cases were diagnosed as reverse syndrome, Swyer syndrome, or 46 XY gonadal dysgenesis. All patients present with a female phenotype and normally developed Mullerian ducts, streak gonads, poorly developed breasts, and primary amenorrhea. The chromosomal analysis showed a male karyotype (46, XY) with a negative SRY gene in the complementary PCR analysis. The SRY mutation might be either de novo during spermatogenesis or deletion due to unexpected cross-over of the SRY gene to the X chromosome during the meiotic process of spermatogenesis, eventually giving rise to a sperm with a Y chromosome devoid of the SRY gene or a mutated gene. Fertilization of this Y-bearing sperm (mutated SRY or deleted SRY) with a normal X-bearing ovum gives rise to a sex-reversed female with a karyotype of 46, XY. Even though the sex-reversed females carry both X and Y sex chromosomes, the undifferentiated gonad fails to develop into a testis due to the absence of the SRY gene. Testosterone and anti-Mullerian hormone (AMH) are not produced, leading to decreased virilization and the development of a female phenotype. As the Wolffian duct fails to develop, the internal male organs are not formed. The absence of AMH allows the development of the uterus, fallopian tubes, cervix, and vagina. In 10%-15% of cases of female sex reversal, an SRY gene mutation was seen. The remaining cases may be due to mutations of other genes involved in sex differentiation pathways, such as the autosomal genes SOX9 and WT1 and the DAX1 gene on the X chromosome. Gonadal dysgenesis is associated with an increased risk of gonadal tumors. Hence, early diagnosis is crucial, given the risk of developing germ cell tumors at an early age.[24]

In some of our cases, the clinical diagnosis of Ovotesticular DSD (OT-DSD) was revealed in patients with normal male karyotypes (46, XY), female karyotypes (46, XX), or mosaic ones (46, XX/46, XY). The clinical tool to differentiate OT-DSD from mixed gonadal dysgenesis lies in the asymmetrical gonadal dysgenesis in cases of OT-DSD, i.e., one well-developed gonad that can be identified as a testis or ovary, whereas the other is a rudimentary streak gonad. It is essential to differentiate between the two distinct conditions for genetic counseling and gender assignment. Moreover, patients with mixed gonadal dysgenesis are at risk of developing malignant germ cell tumors and, therefore, need preventive gonadectomy.[25,26]

CONCLUSION

The present study showed a high number of abnormal karyotypes among patients with PA. This implies the critical role of chromosomal analysis in the workup of patients with PA. Patients with normal karyotypes may need complementary PCR tests for the SRY gene to help identify other disorders with no karyotypic abnormalities.

DECLARATIONS

Conflicts of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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Data Availability

All data from this study are available upon request.

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HOUSEHOLDS' WILLINGNESS TO PAY AND ASSOCIATED FACTORS FOR THE NUTRITION SERVICES PROVIDED TO WOMEN STAYING AT MATERNITY WAITING HOMES IN EAST WOLLEGA, WESTERN ETHIOPIA

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ABSTRACT

BACKGROUND: In Ethiopia, most maternity waiting homes lack government funding and rely on community contributions. However, the willingness of households to pay for nutrition services has not been widely studied. This study aimed to determine the maximum households' willingness to pay for nutrition services at maternity waiting homes and its associated factors in the East Wollega Zone of Oromia National Regional State, Ethiopia.

METHODOLOGY: A community-based cross-sectional study using a double-bounded dichotomous choice contingent valuation method was conducted on 845 households. Data were entered using Epi-Data version 3.1 and analyzed with SPSS for Windows version 20. Binary and multivariable logistic regression analyses were performed. Explanatory variables with p-values less than 0.05 at a 95% confidence level were reported as significantly associated with the outcome variable using an adjusted odds ratio and confidence interval.

RESULTS: The annual median maximum willingness to pay was 15 ETB (US$0.55) per household. Marital status (AOR = 3.533, 95% CI = 1.007-12.39, p-value = 0.05) and average monthly income (AOR = 3.287, 95% CI = 1.194-9.049, p-value = 0.04) were significant factors. Additionally, distance from the health facility (AOR = 3.64, 95% CI = 1.256-10.55, p-value = 0.03), availability of food (AOR = 3.714, 95% CI = 1.331-10.364, p-value = 0.05), sufficient bedding (AOR = 5.353, 95% CI = 2.207-13.010, p-value = 0.001), and cooking utensils (AOR = 4.044, 95% CI = 1.353-12.088, p-value = 0.05) at the housing facility were predictors.

CONCLUSION AND RECOMMENDATION: The households' maximum willingness to pay for nutrition services at maternity waiting homes is relatively high. Demographic, socioeconomic, and institutional factors influenced households' willingness to pay. Health facility managers should ensure necessary utensils are available at maternity waiting homes to sustain the provision and utilization of services.

KEYWORDS: maternity waiting home, willingness to pay, associated factors, Ethiopia

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INTRODUCTION

The chances of women dying as a result of complications during pregnancy, delivery, or the postpartum period remain high in many parts of the world. Lack of access to obstetric services is a primary cause of the high incidence of maternal and newborn deaths. Long distances, poor transport facilities, and inadequate distribution of healthcare facilities contribute to the low utilization of healthcare services in many rural districts in low-income countries.[1–5] Studies indicate that delay number one accounts for 33% of maternal mortality in Ethiopia, while delays number two and three account for 32% and 29% of maternal deaths, respectively.[26]

Maternity waiting homes (MWHs) are residential facilities located near qualified medical centers where pregnant women can wait to give birth. These home-like environments could play a key role in ensuring access to comprehensive maternity care if communities are willing to help sustain them. The aim of the MWH is to improve accessibility and reduce morbidity and mortality for mothers and neonates should complications arise.[4,7] To improve the sustainability of these community-owned and managed shelters, contributions, either in the form of individual donations or an annual community contribution, have the potential to support the long-term financial viability of the shelters.[8–10]

In Ethiopia, many MWHs were built with community support, which usually includes financial contributions for the services provided to mothers staying at these waiting homes. Funding is required to lower other barriers to utilization, such as food provision. Most (86%) of the MWHs had no budget allocated from government funds, resulting in a shortage of revenue for the long-term sustainability of MWH services.[11–13]

Household contributions are necessary to improve the sustainability of these community-owned and managed shelters; however, it is unknown how much they might be willing to contribute and what factors determine their willingness to pay for the services. Shortages of food, kitchen utensils, and fuel, as well as a lack of basic social and healthcare services such as adequate bedding, water, and sanitary services, and lack of visits to mothers staying at an MWH, are some of the barriers to access and utilization.[4,6,9,11-13]

High-risk and pregnant women from remote areas visit and stay at an MWH in their final weeks of pregnancy (about 15 days prior) and for some days after delivery.[6,25] Although the expected amount of money to be paid by households annually is 10 ETB, the actual amount varies from place to place or region to region.

Since there is no predetermined tariff defining the average amount households should pay for the service, the level of household involvement and income collected thus far is insufficient. Furthermore, because the contribution is optional, some households may decide to make the payment while others may not, raising doubts about the program's long-term viability. To establish evidence for tariff setting and address the factors contributing to the unwillingness to pay for the service, it is crucial to ascertain the average maximum households' willingness to pay (MWTP) for the service and its associated elements.

METHODS

Study Area and Period

The study was conducted in the East Wollega zone between August and September of 2018. The zone, located in western Ethiopia, is part of the Oromia Regional State and is situated 333 km from Addis Ababa, the capital city of Ethiopia. There are seventeen woredas in the zone, with community involvement and provision of nutritional services in all woredas. However, only maternity waiting homes in eleven woredas were functional at the time of the study (East Wollega Zonal Health Department, 2018).

Study Design and Source Population

A community-based cross-sectional study design was employed, with all households in the zone as the source population. The study population consisted of all households in the selected kebeles.

Sample Size and Sampling Procedures

The sample size was determined using a single population proportion formula (n = (Zx/2)^2 p (1-p)/d^2), taking a proportion (p) of 50% due to the lack of similar studies[15]. The maximum possible sample size was 845, including a 10% non-response rate and multiplying by a design effect of two. Nine woredas and thirty-two kebeles were randomly selected using the lottery method, and the households were proportionally allocated to their respective kebeles[16] (Table 1).

Table 1: Sampling procedures of the study areas and the study participants in East wollega Zone, Oromia regional state, Ethiopia, 2018.

PName of randomly selected woredas	B/Boshe	W/Hagalo	W/Tuqa	S/Sire	L/Dulacha	J/Arjo	G/Gida	G/Sayo	Diga	Total
Proportionally allocated numbers of kebeles	3	3	3	3	4	4	4	4	4	32
Proportionally allocated numbers of households	65	83	82	132	77	149	105	69	83	845

Data Collection Tools and Techniques

Data were collected using a face-to-face interviewer-administered questionnaire. The data collectors offered a bidding game to the household representative (husband or spouse) since they typically decide on the household budget. To determine their willingness to pay, the initial bidding price was the currently proposed price of 10 ETB (East Wollega Zonal Health Department, 2018). Depending on the respondents' response to the initial price, 2 ETB was added or subtracted in two incremental or detrimental stages, respectively, before asking for the maximum willingness to pay (WTP Max). The bidding game was conducted as follows (Fig. 1).

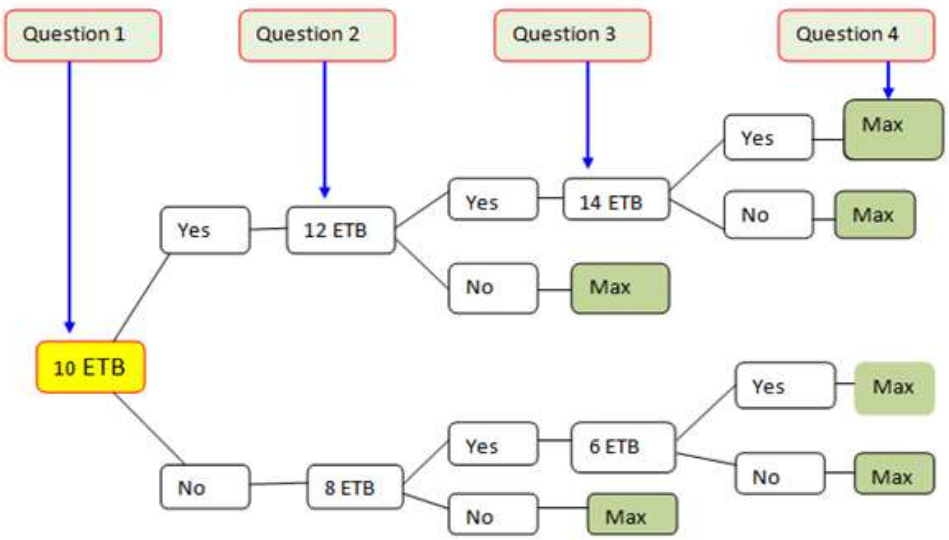

Figure 1: Sequence of willingness to pay questions depending on respondents' response to each price bid, 2018.

Data Analysis

Data were entered using Epi-Data version 3.1 and analyzed using SPSS for Windows version 20. Frequency distribution of dependent and independent variables was performed. Independent variables with a p-value less than 0.25 in bi-variable analysis were considered candidate variables and entered into multivariable logistic regression analysis to check associations with the outcome variable. The association between independent and dependent variables was presented using adjusted odds ratios with 95% confidence intervals.

Data Quality Assurance

The questionnaire was adapted and translated into the local language (Afan Oromo). Training was provided for data collectors and supervisors on data collection tools. A pretest was conducted on 15% of the sample size before the actual data collection period. Supervisors checked the completeness of the questionnaires immediately during data collection. Data were entered and double-entered into Epi-Data to check for errors during data entry.

RESULTS

Socio-Demographic Characteristics of the Respondents

Out of 845 households included in the study, 830 responded to the questions, resulting in a 98% response rate. More than half of the respondents (54.7%) were young female household heads with a mean age of 30.58 years (SD ± 8.6). The majority of the participants (83.7%) were married, and the average household family size was 5.07 (SD ± 1.95) (Table 2).

Table 2: Socio-demographic characteristic of the respondents in East Wollega Zone, Oromia regional sate, Ethiopia, 2018

Variables	WTP for the nutrition service		Total
	WTP <10 ETB	WTP>= 10ETB	
Sex			
Male	17(36.2)	359(45.8)	376
Female	30(63.8)	424(54.2)	454
Age			
18-24 years	19(40.4)	159 (20.3)	178
25-34 years	15(31.9)	392 (50.1)	407
35-44 years	4(8.5)	190(24.3)	194
45 years and above	9(19.1)	42 (5.4)	51
Marital status			
Married	34(72.3)	661(84.4)	695
Single	13(27.7)	122(15.6)	135
Ethnicity			
Oromo	43(91.5)	726(92.7)	769
Amhara	4(8.5)	57(7.3)	61
Religion			
Orthodox	17(36.2)	253(32.3)	270
Muslim	9(19.1)	99(12.6)	108
Protestant	21(44.7)	431(55)	452
Educational status			
Illiterate	30(63.8)	290(37)	320
Can read and write	7(14.9)	70(8.9)	77
Elementary (1-8)	9(19.1)	305(39)	314
Secondary(9-12)	0(0)	78(10)	78
College and above	1(2.1)	40(5.1)	41
Occupational status			
Farmer	23(48.9)	459(58.6)	482
Student	0(0)	9(1.1)	9
House wife	15(31.9)	116(14.8)	131
Government Employer	2(4.3)	78(10)	80
Merchant	0(0)	79(10.1)	79
Daily laborer	7(14.9)	42(5.4)	49
Average monthly income			
Less than 200 ETB	7(14.9)	92(11.7)	99
200-400 ETB	13(27.7)	149(19)	162
401-692 ETB	18(38.3)	191(24.4)	209
Greater than 692 ETB	9(19.1)	351(44.8)	360
Distance of the HHs from the health facility			
Less than 5KM	40(85.1)	553(70.6)	593
Greater or equal to 5km	7(14.9)	230(29.4)	237

Households' Willingness to Pay (WTP) for the Nutrition Service Provided to Women Staying at MWH

Among 830 respondents, 783 (94.3%) were willing to pay 10 ETB or more, while only 47 (5.7%) were willing to pay less than 10 ETB, with a minimum of 5 ETB and a maximum of 8 ETB for the service. The households' maximum willingness to pay for the nutrition service was 15 ETB (0.55 USD) per year per household. About 45.2% of the households were willing to pay below the median amount, and 43% were willing to pay above the median amount (Figure 2).

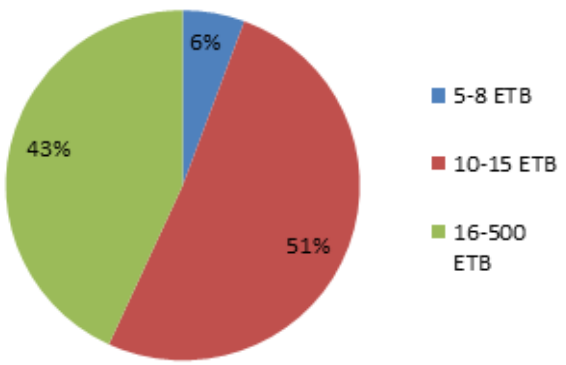

Figure 2: Percentage of respondents willing to pay a certain range for the nutrition service (Exchange rate: US$1=27.471 ETB, source (18).

Determinants of Households' Willingness to Pay for the Nutrition Service

The MWTP of a group of respondents with a mean age of 52.78 years (SD ± 8.09) was nearly 94% lower than the MWTP of a group with a mean age of 28.42 years (SD ± 2.56). On the other hand, respondents who were ever married had a higher willingness to pay (AOR = 3.533, 95% CI = 1.007-12.39) than their unmarried counterparts. Household heads with a college or above education level had a lower willingness to pay (AOR = 0.346, 95% CI = 0.14-0.857) compared to illiterate counterparts. Respondents who were housewives (AOR = 2.625, 95% CI = 1.075-6.413) and daily laborers (AOR = 3.593, 95% CI = 1.068-12.089) had a higher willingness to pay than farmers.

Respondents with a median monthly income of 1000 ETB (AOR = 3.287, 95% CI = 1.194-9.049) were more likely to have a higher WTP for the service compared to those with a median monthly income of 100 ETB. Respondents living closer to the health facility (less than 5 km) (AOR = 3.64, 95% CI = 1.256-10.55) had a higher willingness to pay than those living farther away (greater than 5 km). Furthermore, WTP was positively affected by the availability of quality food (AOR = 3.714, 95% CI = 1.331-10.364), beddings (AOR = 5.353, 95% CI = 2.207-13.010), and cooking facilities (AOR = 4.044, 95% CI = 1.353-12.088) at a MWH (Table 3).

Table 3: Predictors of WTP for the nutrition provided to women staying at a MWH in East Wollega Zone, Oromia regional state, Ethiopia, 2018.

Variables		WTP for the nutrition servic		OR and 95% CI	
		<10ETB n=47(%)	<10ETB n=783(%)	COR(95%CI)	AOR(95%CI)
Age					
18-24 years		19(40.4)	159(20.3)	1	
25-34 years		15(31.9)	392(50.1)	0.558(0.235-1.322)	0.368(0.115-1.74)
35-44 years		4(8.5)	190(24.3)	0.179(0.074-0.433)	0.09(0.027-0.3)***
45 years and above		9(19.1)	42 (5.4)	0.098(0.029-0.334)	0.06(0.013-0.25)***
Marital status					
Never married		13(27.7)	122(15.6)	1	
Ever married		34(72.3)	661(84.4)	2.072(1.036-4.039)	3.53(1.007-12.39)*
Educational status					
Illiterate		30(63.8)	290(37)	1	
Can read and write		7(14.9)	70(8.9)	0.273(0.185-0.623)	0.510(0.167-1.554)
Elementary (1-8)		9(19.1)	305(39)	0.285(0.133-0.611)	0.108(0.004-2.945)
Secondary(9-12)		0(0)	78(10)	0.351(0.132-0.597)	0.284(0.175-1.05)
College and above		1(2.1)	40(5.1)	0.242(0.032-1.82)	0.346(0.140-0.86)*
Occupational status					
Farmer		23(48.9)	459(58.6)	1	
House wife		15(31.9)	116(14.8)	2.581(1.305-5.102)	2.63(1.08-6.4)*
Daily laborer		7(14.9)	42(5.4)	3.33(1.35-8.21)	3.59(1.1-12.1)*
Average monthly income					
Less than 200 ETB		7(14.9)	92(11.7)	1	
200-400 ETB		13(27.7)	149(19)	2.967(1.076-8.18)	1.307(0.34-5.020)
401-692 ETB		18(38.3)	191(24.4)	3.403(1.424-8.132)	2.55(0.828-7.863)
Greater than 692 ETB		9(19.1)	351(44.8)	3.675(1.62-8.339)	3.29(1.194-9.049)*
Distance of the HH from the health facility					
Less than 5KM		40(85.1)	553(70.6)	2.377(1.049-5.383)	3.6 (1.256-10.557)*
Greater or equal to 5 KM		7(14.9)	230(29.4)	1.00	
Availability of food at a MWH	Yes	40(85.1)	533(68.1)	2.68(1.184-6.067)	3.7(1.331-10.364)*
	No	7(14.9)	250(31.9)	1.00	
Availability of water at a MWH	Yes	41(87.2)	570(72.8)	2.554(1.069-6.101)	1.79(0.551-5.820)
	No	6(12.8)	213(27.2)	1.00	
Availability of beddings at a MWH	Yes	34(72.3)	415(53)	2.319(1.205-4.62)	5.35(2.21-13)***
	No	13(27.7)	368(47)	1.00	
Availability of cooking facilities at a MWH	Yes	31(66)	433(55.3)	1.566(0.843-2.91)	4.04(1.4-12.1)*
	No	16(34)	350(44.7)	1	
Effect of peers	Yes	14(29.8)	421(53.8)	1.00	
	No	33(70.2)	362(46.2)	2.741(1.444-5.203)	2.7(1.204-6.011)*
Affordability	Yes	29(61.7)	287(36.7)	2.784(1.519-5.103)	3.61(0.748-17.382)
	No	18(38.3)	496(63.3)	1.00	
Service quality	Yes	45(95.7)	694(88.6)	2.885(0.688-12.1)	1.1 (0.19-6.112)
	No	2(4.3)	89(11.4)	1.00	
Perceiving as it is the government's responsibility	Yes	17(36.2)	464(59.3)	1.00	
	No	30(83)	319(40.7)	2.567(1.392-4.733)	3.6 (1.7-7.95)***
Availability of electric power at the MWH	Yes	45(95.7)	667(85.2)	3.913(0.936-16.35)	3.61(0.748-17.382)
	No	2(4.3)	116(14.8)	1.00	
Availability of kitchen at a MWH	Yes	41(87.2)	563(71.9)	2.67(1.118-6.378)	1.25(0.406-3.822)
	No	6(12.8)	220(28.1)	1.00	
Availability of adequate firewood at a MWH	Yes	39(83)	516(65.9)	2.523(1.162-5.475)	2.52(0.933-6.78)
	No	8(17)	267(34.1)	1.00	

*p-value<0.05, **p-value < 0.01, ***p-value<0.001, 1=reference

DISCUSION

The majority of respondents were willing to pay for the services, with their maximum willingness to pay (WTP) per household per year being 15 ETB (~US$0.55). This figure is higher than the amount the government has set, indicating that respondents are willing to pay more than the current rate. However, the nutrition service program at MWHs suffers from a revenue shortage.

Older household heads demonstrated a higher willingness to pay compared to their younger counterparts. This finding aligns with studies conducted by WHO and in Liberia.[6,19] A possible explanation is that older female household heads, having experienced more births and living in rural areas, might have encountered nutrition service delivery at health facilities, which are primarily located in towns. Similarly, in line with studies in Ethiopia,[6,21] respondents who were ever married were about 3.5 times more likely to be willing to pay for the service than those who were never married. This could be due to the maternity experience of married women, who are more likely to have utilized and benefited from nutrition services at MWHs.

Respondents with a college education or higher had a 65.4% lower maximum willingness to pay compared to illiterate respondents. This finding is consistent with a study conducted in Ethiopia.20 The lower willingness to pay among more educated respondents may be due to their perception of higher-risk maternity care services. Educated individuals might also perceive the quality of such services differently.

Income was a significant determinant of WTP. Those with a median monthly income of 1000 ETB were nearly three times more likely to be willing to pay above the current price compared to those with a median monthly income of 100 ETB. This finding aligns with economic theory, which suggests that higher income increases willingness to pay for normal goods. It is also consistent with empirical studies conducted in Ethiopia.[20] Respondents living less than 5 km from a health facility were 3.6 times more likely to have a higher WTP than those living more than 5 km away. This suggests that households farther from health facilities may have less awareness of the service's importance. This finding is supported by studies conducted in China and Ethiopia.[22,23]

Respondents' perceptions of the quality of nutrition services (e.g., food, bedding, and cooking facilities) at MWHs also influenced their WTP. Households that believed there were adequate food, bedding, and cooking facilities at the MWH were more likely to be willing to pay. This is consistent with findings from a study conducted in the Netherlands.[24]

CONCLUSION

This study shows that households are willing to pay for nutrition services, suggesting that the government could increase the fee charged, as the households' maximum willingness to pay exceeds the current membership fee. Demographic, socioeconomic, and institutional factors affect households' maximum willingness to pay (MWTP). Additionally, perceptions of service quality also influence WTP for the service.

RECOMMENDATIONS

As the program is monitored and evaluated by the Oromia Health Bureau, the Zonal Health Department, and the Woreda Health Offices, they should collaborate to revise the fee to sustain service provision and enhance functionality at all levels of the health facility. Health facility governing bodies should ensure the availability of food items, cooking utensils, and enough beds at a Maternity Waiting Home (MWH), as these factors affect households' willingness to pay.

DECLARATIONS

Limitation of the study

This is study is based on the respondents' stated preferences to the services which does not mean the households are committed

Abbreviations

AOR: Adjusted Odd Ratio,

DBDC: Double Bounded Dichotomous,

CVM: Contingent Valuation Method,
ETB: Ethiopian Birr,
FMOH: Federal Ministry of Health,
HC: Health Center,
HDA: Health Development Army,
HEW: Health Extension Workers,
HF: Health Facility,
HH: Household,
JU: Jimma University,
MNCH: Maternal Neonatal and child health services,
MWH: Maternity Waiting Home,
NGO: Non-governmental Organization,
OR: Odd Ratio,
SD: Standard Deviation,
SMAGs: Safe Motherhood Action Groups,
SPSS: Statistical Package for the Social Sciences,
USD: United States Dollar,
WHO: World Health Organisation,
WTP: Willingness to Pay

Ethical Approval

The study was approved by Jimma University ethical review board. Permission to collect data was obtained from east Wollega zone health administration office.

Consent for Publication

Not applicable for this research

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Funding

Not applicable

Consent to Participate

A free informed consent written or verbal was obtained from each individual participant at the start of the study.

Authors' Contribution

AE, participated in the conception, design, acquisition and analysis and the interpretation of the work. TD, supervised all the activities and drafted the manuscript. GJ, substantively revised and prepared the final draft of the manuscript. And all authors read and approved the final version of the manuscript and agreed on the submission of the manuscript to this journal.

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GESTATIONAL DIABETES MELLITUS AND PSYCHOLOGICAL STRESS IN BANGLADESHI WOMEN: A CROSS-SECTIONAL COMPARATIVE STUDY

Running title: GDM and Psychological Stress

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ABSTRACT

BACKGROUND: Gestational Diabetes Mellitus (GDM) is a common disorder among pregnant women, increasing their vulnerability to psychological stress compared to non-GDM pregnant women. Motherhood is already a significant life-changing and stressful condition. Developing diabetes during pregnancy elevates women's psychological stress levels, leading to pregnancy-related complications and poor neonatal outcomes. This study aims to explore and compare the psychological stress of GDM in pregnant women with non-GDM women.

METHODS: This cross-sectional comparative study investigated diabetes-related distress using the Depression, Anxiety Stress Scale-21 (DASS-21) and the Problem Areas in Diabetes Scale-5 (PAID-5) in purposively selected 75 pregnant women with GDM and compared them to 75 non-GDM women attending antenatal checkups at BIHS General Hospital, Dhaka.

RESULTS: The average age of the pregnant women was 27.71±5.10 (GDM mean= 29.48±4.57, non-GDM mean= 25.95±5.02). Pregnant women with GDM had more stress (57.3%), anxiety (46.7%), and depression (61.3%) compared to non-GDM women ($p<.001$). According to DASS-21, among all women with GDM, 25.3% had moderate stress, 22.7% mild depression, and 29.3% extreme-severe anxiety. According to the PAID-5 scale, more than half (63%) of the GDM women had diabetes-related emotional distress.

CONCLUSION: Women with GDM are more likely to have psychological distress compared with non-GDM pregnant women. Interventions are needed to improve access to diabetes and mental health care with appropriate tools, such as digital technology-based health interventions.

KEYWORDS: Pregnant Women, Gestational Diabetes Mellitus, Psychological Stress, DASS scale, PAID-5 scale.

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INTRODUCTION

Gestational diabetes mellitus (GDM) is one of the most common disorders affecting pregnant women worldwide, although its prevalence varies due to different diagnostic criteria.[1,2] It is defined as "any glucose intolerance with onset or first recognized during pregnancy."[2] A recent meta-analysis revealed that, based on the International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria, the global prevalence of GDM is 14.7%.[1,3] GDM affects 20.8% of pregnant women in South-East Asia.[1] Demographic Health Survey findings indicate the prevalence of GDM in Bangladesh ranges from 6.8% to 40.3%, and this number is increasing.[2]

It is estimated that one in ten pregnancies is associated with diabetes, 90% of which are diagnosed as GDM.[4-6] Compared to healthy pregnant women, those with GDM are more likely to develop high blood pressure and consequently, preeclampsia or eclampsia during pregnancy. As a result, these women are at risk of developing type 2 diabetes and cardiovascular diseases later in life.[7,8] Furthermore, the babies of mothers with GDM can develop macrosomia, low blood sugar, breathing problems at birth, and type 2 diabetes later in life.[9,10]

GDM has also been linked with adverse psychological health consequences. In low- and middle-income countries, women with GDM and antenatal depression have a poor quality of life and are at risk of adverse pregnancy and fetal outcomes.[11,12] Stress can lead to negative pregnancy outcomes such as preeclampsia, prematurity, and low birth weight.[13,14] This reactivity to stress, higher during the early part of pregnancy, is attributable to increased serum cortisol levels and can lead to prematurity.[15] Chronically increased cortisol levels can raise blood glucose levels and potentiate insulin resistance, which shares the pathogenesis of GDM.[16,17] There is conflicting evidence in the literature regarding the relationship between psychological stress, like anxiety and depression, and GDM. Research suggests that anxiety and stress can play an important role in the development of GDM. Conversely, GDM is considered a risk factor for antepartum and postpartum depression.[18]

Like other forms of diabetes mellitus, GDM can affect the psychological well-being of individuals living with this condition.[19] This is especially important during pregnancy, which is a major cause of complications, morbidity, and mortality in a woman's life. Considering the lower access to healthcare by women in Bangladesh, adhering to GDM treatment can be difficult during pregnancy. Effective management of GDM is crucial to improve pregnancy outcomes in a population where utilization of antenatal care is often suboptimal.[20] Therefore, considering the paucity of data on GDM and psychological stress in Bangladesh, this study aims to compare the psychological stress, in the form of anxiety, stress, and depression, in pregnant women living with or without GDM.[21]

METHOD

This is a cross-sectional comparative study on women with GDM (GDM group) and without GDM (non-GDM group). The study was conducted over 3 months (October 2022 to December 2022). Pregnant women seeking antenatal care at the Bangladesh Institute of Health Sciences (BIHS) General Hospital in Dhaka were the study population. This hospital is affiliated with the Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) and provides a range of general health services. A total of 150 pregnant women, equally divided into two groups—75 with GDM and 75 without GDM—were selected as the sample. Respondents were purposively selected for the study to compare pregnant women with and without the characteristics. Gestational Diabetes Mellitus was diagnosed according to the WHO (2013) OGTT criteria for GDM during antenatal visits.[22] Ethical approval was obtained from Bangladesh University of Health Sciences. Verbal and written consent were obtained before administering the interview.

The Depression Anxiety Stress Scale-21 (DASS-21) and the Problem Areas in Diabetes Scale (PAID-5) were used to investigate diabetes-related distress. The DASS is a 21-item self-administered questionnaire designed to measure the magnitude of three negative emotional states: depression, anxiety, and stress.[23] The validated Bangla version of DASS-21 was utilized for this study.[24] Each of the three domains of psychological stress (anxiety, stress, and depression) is assessed with the scale. Based on the score of responses to specific statements, the result is expressed as mild, moderate, severe, and extremely severe. Details of scoring are available elsewhere.[25] The PAID-5 is a 5-item self-reported instrument for measuring diabetes-related emotional distress and covers a range of negative emotional problems of patients with diabetes.[26] Appropriate descriptive and inferential statistical analyses were performed. Statistical significance was set at $p<.001$.

Results

Table 1: Socio-demographic-anthropometric characteristics of participants

Factors	Group	GDM (N=75) n (%)	Non-GDM (N=75) n (%)	All (N=150) n (%)
Age Group (Years)	18-22	3 (4.0%)	19 (25.3%)	22(14.8%)
	23-32	54 (72.0%)	49 (65.3%)	103(68.6%)
	33-37	15 (20.0%)	5 (6.7%)	20(13.3%)
	>37	3 (4.0%)	2 (2.70%)	5(3.3%)
Age (Years) (Mean ± SD)		29.48±4.57	25.95±5.02	27.71±5.10
Level of Education	Illiterate	2(2.7%)	0(0.0%)	2(1.3%)
	Primary	8(10.7%)	15(20.0%)	23(15.3%)
	Secondary	27(36.0%)	32(42.7%)	59(39.3%)
	Graduate and above	42(56.0%)	30(38.0%)	72(48.0%)
Residence	Urban	66(88.0%)	67(89.3%)	133(88.7%)
	Rural	9(12.0%)	8(10.7%)	17(11.3%)
Occupation	Housewife	55(73.3%)	60(80.0%)	115(76.7%)
	Service Holder	17(22.7%)	4(5.3%)	21(14.0%)
	Business	1(1.3%)	0(0.0%)	1(0.7%)
	Others	2(2.7%)	11(14.7%)	13(8.7%)
Monthly Income	Less than BDT 40000	55(73.3%)	64(85.5%)	119(79.3%)
	BDT 40000-80000	18(24.0%)	9(12.0%)	27(18.0%)
	More than BDT 80000	2(2.7%)	2(2.7%)	4(2.7%)
Family type	Nuclear	48(64.0%)	44(58.7%)	92(61.3%)
	Joint/Extended	27(36.0%)	31(41.3%)	58(38.7%)
BMI (Pre-pregnancy/ 1st trimester)	<18.5	3(4.0%)	4(5.3%)	7(4.7%)
	18.5 to <25	20(26.7%)	34(45.3%)	54(36.0%)
	25 to <30	39(52.0%)	27(36.0%)	66(44.0%)
	≥30	13(17.3%)	10(13.3%)	23(15.3%)
BMI (Pre-pregnancy/ 1st trimester) (Mean ± SD)		26.76±3.95	25.32±4.33	26.04±4.19

Table 1 describes the socio-demographic-anthropometric characteristics of the GDM and non- GDM pregnant women. Majority of the GDM affected pregnant women belonged to the age group of 23–32 years (72%) where as 65.3% from non-GDM group. Average age of the pregnant women was 27.71±5.10. Mean age of pregnant women is higher in GDM group. Nearly all pregnant women were living in urban area. Majority of the pregnant women were housewife. The mean BMI was higher in the GDM group.

Table 2: Distribution of pregnant women according to DASS-21

Criteria	Stress GDM		Depression GDM		Anxiety GDM	
Scale	No	Yes	No	Yes	No	Yes
Mild	9	16	5	17	0	0
	12.0%	21.3%	6.7%	22.7%	0.0%	0.0%
Moderate	7	19	10	15	4	7
	9.3%	25.3%	13.3%	20.0%	5.3%	9.3%
Severe	3	7	1	8	5	6
	4.0%	9.3%	1.3%	10.7%	6.7%	8.0%
Extreme-Severe	0	1	0	6	4	22
	0.0%	1.3%	0.0%	8.0%	5.3%	29.3%

Table 2 shows that among the GDM group, 25.3% had moderate stress, 22.7% had mild depression, and 29.3% had extreme-severe anxiety (according to DASS-21).

Table 3: DASS-21 score for psychological distress of both groups

Variable	GDM Median (min-max)	Non-GDM Median (min-max)	GDM vs Non-GDM
Depression	10 (0-34)	4 (0-24)	.000* †
Anxiety	8 (0-34)	6 (0-24)	.000* †
Stress	16 (0-38)	8 (0-28)	.000* †

*p<0.001,† = Mann-Whitney U test

Table 3 depicts the mean difference in DASS-21 score regarding depression, anxiety and stress between women with GDM and women without GDM was statistically significant. The median score for all three psychological distress domains were higher in the GDM group.

Table 4: Comparison between GDM and non-GDM pregnant women according to demographics and psychological stress

Variables		Depression GDM n (%)	Anxiety Non-GDM n (%)	Stress GDM n (%)	Non-GDM n (%)	GDM n (%)	Non-GDM n (%)
Age Group (years)	18-22	2 (4.3%)	3 (18.8%)	1 (2.9%)	1 (7.7%)	2 (4.7%)	2 (10.5%)
	23-27	16 (34.8%)	7 (43.8%)	10 (28.6%)	5 (38.5%)	15 (34.9%)	9 (47.4%)
	28-32	16 (34.8%)	5 (31.3%)	14 (40.0%)	5 (38.5%)	15 (34.9%)	5 (26.3%)
	33-37	9 (19.6%)	0 (0.0%)	7 (20.0%)	1 (7.7%)	8 (18.6%)	1 (5.3%)
	More than 37	3 (6.5%)	1 (6.3%)	3 (8.6%)	1 (7.7%)	3 (7.0%)	2 (10.5%)
Residence	Urban	30 (65.2%)	10 (62.5%)	21 (60.0%)	9 (69.2%)	28 (65.1%)	13 (68.4%)
	Peri-Urban	11 (23.9%)	4 (25.0%)	9 (25.7%)	3 (23.1%)	10 (23.3%)	4 (21.1%)
	Rural	5 (10.9%)	2 (12.5%)	5 (14.3%)	1 (7.7%)	5 (11.6%)	2 (10.5%)
Level of education	Illiterate	2 (4.3%)	0 (0.0%)	2 (5.7%)	0 (0.0%)	2 (4.7%)	0 (0.0%)
	Primary	5 (10.9%)	3 (18.8%)	3 (8.6%)	2 (15.4%)	5 (11.6%)	3 (15.8%)
	Secondary	15 (32.66%)	9 (56.3%)	13 (37.1%)	6 (42.2%)	14 (32.6%)	8 (42.1%)
	Graduate and above	20 (43.5%)	3 (18.8%)	15 (42.9%)	4 (30.8%)	18 (41.9%)	5 (26.3%)
	Others	4 (8.7%)	1 (6.3%)	2 (5.7%)	1 (7.7%)	4 (9.3%)	3 (15.8%)
Monthly Income	Less than BDT 26000	9 (19.6%)	6 (37.5%)	8 (22.9%)	3 (23.1%)	9 (20.9%)	7 (36.8%)
	BDT 26000-50000	23 (50.0%)	8 (50.0%)	15 (42.9%)	8 (61.5%)	21 (48.8%)	9 (47.4%)
	BDT 51000-75000	9 (19.6%)	1 (6.3%)	8 (22.9%)	1 (7.7%)	9 (20.9%)	0 (0.0%)
	BDT 76000-100000	3 (6.5%)	0 (0.0%)	2 (5.7%)	0 (0.0%)	3 (7.0%)	1 (5.3%)
	More than BDT 100000	2 (4.3%)	1 (6.3%)	2 (5.7%)	1 (7.7%)	1 (2.3%)	2 (10.5%)
Family type	Nuclear	29 (63.0%)	11 (68.8%)	22 (62.9%)	10 (76.9%)	27 (62.8%)	12 (63.2%)
	Joint	17 (37.0%)	5 (31.3%)	13 (37.1%)	3 (23.1%)	16 (37.2%)	7 (36.8%)

Depression and stress were more common in pregnant women of 23-27 years of age (34.8% and 34.9% respectively) while anxiety in common in the age group of 28-32 (40.0%) (Table 4). Pregnant women living in an urban area had higher proportion of depression, anxiety, and stress (65.2%, 60.0% and 65.1% respectively). The three types of psychological stress were more common in women living in a nuclear family while being pregnant than those living in a joint/extended family.

Observations from using PAID scale demonstrated that the pregnant women in GDM group (63%) scored ≥8 indicating the presence of diabetes-related distress, whereas rest of the pregnant women (37%) obtained a score <8 (Table 5).

Table 5: Distribution of respondents according to PAID-5 score

PAID -5 Score	Frequency (%)
Possible Diabetes Related Emotional Distress (≥8)	47 (63%)
No Diabetes Related Emotional Distress (<8)	28 (37%)
Total	**75 (100%)**

Pregnant women with GDM experienced more stress (57.3%), more anxiety (46.7%) and more depression (61.3%) compare to non-GDM pregnant women (p<.001) (Table 6).

Table 6: Association between GDM and non-GDM pregnant women and psychological stress

	Stress		Significance	Anxiety		Significance	Depression		Significance
	No	Yes		No	Yes		No	Yes	
Non-GDM	56(74.7%)	32(42.7%)	p = 0.000	62(82.7%)	40(53.3%)	p = 0.000	59(78.7%)	29(38.7%)	p=0.000
GDM	19(25.3%)	43(57.3%)		13(17.3%)	35(46.7%)			16(21.3%)	46(61.3%)

DISCUSSION

The present study compared the psychological distress—such as anxiety, stress, and depression—between pregnant women with GDM and those without GDM. Pregnant women diagnosed with GDM reported higher frequencies of each of these conditions. Utilizing the DASS-21 scoring scale, these women were found to have varying degrees of anxiety, stress, and depression. Emotional distress, detected through the PAID-5 scale, was also more common in this group. The differences between the two groups were statistically significant.

Many women with GDM and psychological stress belonged to a relatively young age group of 23–32 years (72%). Younger women had higher levels of stress, anxiety, and depression. These findings are consistent with similar studies.[27-30] It can be hypothesized that younger pregnant women are less experienced in coping with the demands of pregnancy and associated lifestyle changes.

Literature indicates that socio-demographic factors are strongly linked with GDM and its psychological effects on women.[27,28,31,32] In this study, the majority (73.3%) of GDM pregnant mothers belonged to the lower-income group, which increases the risk of adverse pregnancy outcomes. Lack of awareness, low health-seeking behavior, financial constraints, and mental health issues can create vulnerability for pregnancy and potential delivery complications. This can lead to abortion, preterm delivery, preeclampsia, eclampsia, obstructed labor, and psychological distress.[33] A systematic review demonstrated that women in the low socio-economic group commonly develop psychological distress during gestation.[18]

Completing higher education and having a stable career with financial security are considered to lower the risk of mental distress for women.[29,34] This study observed similar findings. Better mental health is associated with higher educational attainment. A greater number of life choices and more control over different aspects of life, including health, are benefits of education.[35]

More women in urban areas had one or more psychological distress conditions compared to rural women. This is consistent with findings in a meta-analysis that postulates features of urbanization like higher population density, housing issues, and social isolation as facilitators for any type of psychopathology.[36]

Six out of ten (64.0%) women in the GDM group lived in nuclear families compared to 58.7% in the non-GDM group. A nuclear family consists of parents and children living in a single household, while a joint family is an extended family where three or more generations live together with a single line of authority.[37] Pregnant women with GDM in nuclear families are more likely to experience depression, anxiety, and stress than those in

joint families. Possible reasons include lack of antenatal checkups, continued household chores, and lack of emotional support from family members, which are vital for the health of both the mother and unborn child. Managing GDM can create extra pressure for a woman experiencing additional psychological stress during this period. A study from Turkey revealed that pregnant women living in joint families had more ability to cope with stress.[38] Women who receive emotional support develop fewer complications during pregnancy and can give birth to healthier babies.[39]

A high degree of association was observed between women living with GDM and psychological distress compared to the non-GDM group (DASS-21 scale). Each component of psychological stress was more common in the GDM group. Pregnancy complications such as premature delivery or abortion can increase medical costs, including longer hospital stays, and interfere with the cognitive development of newborns. In Bangladesh, these can strain healthcare resources that are sub-optimal to meet the needs of the population. A recent study revealed that GDM is associated with a high prevalence of depressive symptoms in Bangladesh due to multiple contextual factors.[31] A systematic review in China demonstrated a strong association between GDM and anxiety in pregnant women.[18] In Bangladesh, physicians are often unable to visit patients for extended periods, address their psychological problems, or offer counseling due to high population density and low healthcare human resources, similar to an example observed in northern Bangladesh.[40] However, there may be some exceptions in private healthcare settings, though these services are often too expensive for the general population. In these circumstances, digital technology-based education or counseling could be beneficial for addressing psychological distress in pregnant women.

This study explored the emotional distress of pregnant women with GDM. They were apprehensive about living with diabetes, feeling depressed, worrying about the future, and the possibility of serious complications. They felt that diabetes was taking too much mental and physical energy every day and faced difficulties coping with complications of diabetes.

According to the PAID-5 scale, more than half (63%) of the GDM women in this study had diabetes-related emotional distress. This encompasses anxiety related to pregnancy and unforeseen complications such as difficult labor, economic concerns, and child care expectations, which can ultimately lead to depression exacerbated by the diagnosis of diabetes in pregnancy.[41] This is consistent with a study in Malaysia that found the prevalence of anxiety, stress, and depression symptoms highest among women with GDM.[28] Digital technology-based counseling and education could help manage these problems. Readily available technology like smartphones has the potential to transform care for pregnant women living with chronic diseases like diabetes and mental health issues while respecting privacy and providing patient care in a safe environment. App-based mobile phone solutions have advantages, including portability, continual internet connectivity, and ease-of-use, to provide personalized interventions (e.g., reminders, alerts, voice messages, images, graphics) for GDM patients. The expected result includes alleviation of anxiety and stress and improved pregnancy outcomes for women with GDM.

Previously published data are consistent with the current study in that pregnant women with GDM experience higher levels of anxiety and stress than non-pregnant and healthy pregnant women.[42] Susceptibility to depression or anxiety is increased by the diagnosis of GDM in pregnant women, resulting in a 2-4 times higher likelihood of antenatal or postnatal depression compared to non-GDM women.[43-45] A comparative study revealed pregnant women with diabetes were more prone to and had the highest scores of depression, anxiety, and stress compared with pregnant women without diabetes.[46] A retrospective cohort study ascertained that pregnant women with GDM were twice as likely to develop prenatal depression as those without GDM.[47]

CONCLUSION

Psychological distress was found to be common in pregnant women with GDM. Any degree of anxiety, stress and depression was determined to be higher in pregnant women with GDM. Therefore, intervention strategies (e.g., in-person and digital technology-based psychological education) tailored to individual pregnant woman need to be implemented to increase access to diabetes and mental health care so that every woman can experience a risk-free and healthy pregnancy outcome.

DECLARATIONS

Limitations of the Study

The limitations of this study include its cross-sectional design, which may hinder the ability to infer causal relationships. The small sample size and inclusion of participants from a single hospital limit generalizability. Inherent disadvantages of the purposive sampling technique include selection bias and lack of generalization from sample to study population. The strength of this study lies in exploring and identifying an important but neglected aspect of an increasingly common condition with potential multiple health effects in Bangladesh. Longitudinal research could help identify risk factors that could be targeted for pragmatic interventions to prevent the deleterious short- and long-term consequences of GDM and psychological stress on both mother and child.

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THE MAGNITUDE OF BIRTH INJURIES AND ASSOCIATED FACTORS AMONG NEONATES ADMITTED TO NEONATAL INTENSIVE CARE UNITS OF SELECTED PUBLIC HOSPITALS IN CENTRAL ETHIOPIA

Mandefro Teme[1] , Amene Abebe[1], Daniel Baza[2]

ABSTRACT

BACKGROUND: Approximately half of the birth injuries are avoidable if appropriate and timely evidence based measures are taken. However, there is a paucity of studies in Ethiopia. Therefore, this study aimed to assess the magnitude of birth injuries and associated factors among neonates delivered in Central Ethiopia.

METHODS: Multi-center facility-based cross-sectional study was conducted from March to April 2021. Systematic sampling method was used to select 344 mother-neonate pairs admitted to neonatal intensive care units in the included hospitals. Data were collected using face-to-face interview and review of medical records. Epi-info version 4.1 was used to enter data and SPSS version-25 for analysis. Descriptive statistics, binary and multivariable logistic regressions analyses with 95% CI were done. A cut off value of p-value < 0.05 was used to declare the statistical significance of variables.

RESULTS: The magnitude of birth injuries was 24.7% (95% CI=24.7% - 24.8%). The majority 71.6 % of the neonates had soft tissue injuries while 16.6 % of them had birth asphyxia. Both birth asphyxia and physical trauma were encountered in 2.9 % of the neonates. Fetal mal-presentation (AOR=29.69, 95% CI =10.61 - 43.09), ANC follow–up less than four (AOR=3.2, 95% CI, 1.21-8.33), assisted childbirth (AOR =3.33, 95 % CI=1.003 -11.044) and short maternal height (AOR=4.85, 95% CI, (1.26-20) were significantly associated with birth injuries.

CONCLUSION: The magnitude of birth injuries was higher than other similar studies in Ethiopia. Fetal mal-presentation, antenatal care follow-up less than four, and short maternal height were significantly associated with birth injuries. Thus, promotion of full antenatal care follow-up, close monitoring of mothers during intrapartum period and timely clinical decision of labor and childbirth process of mal-presented children are recommended.

KEYWORDS: Birth trauma, birth injuries, mechanical birth trauma, neonates, newborn, perinatal asphyxia

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INTRODUCTION

Birth injuries are defined as damage of the newborn's body structure or function due to adverse outcomes of the birth processes[1]. Birth injuries can be due to oxygen insufficiency for tissues (birth asphyxia) or physical trauma (birth trauma) during labor or delivery[2]. Despite how much adequate prenatal care is provided, birth injuries could occur due to unavoidable risks such as long and/or difficult labor or fetal mal-presentations[3].

The incidence of birth injuries varies based on the type of delivery, fetal presentations, and type of injury[2]. The spectrum of birth injuries ranges from superficial injury to the skin which is the most common type of injury to the more severe damages of the central nervous system and other soft tissues[4]. Birth injuries can significantly be reduced with the use of appropriate methods of obstetric care to monitor the prognosis of the labor, the fetal status, and by making the timely decision for Cesarean Section (C/S) delivery[4-6].

Skull injury (subgalleal hemorrhage, Caput succedaneum, Cephalohematoma), soft tissue injuries (bruises, petechial and subcutaneous fat necrosis), intra-abdominal (hepatic and splenic injuries), and central nervous system (intracranial hemorrhage, facial nerve palsy injuries), bone (humeral fracture, femoral fracture, and clavicular fracture injuries) and systemic injuries including perinatal asphyxia are the commonest types of birth injuries occurring during the birth process [7,8].

An estimated 7-9 per 1000 live births birth injuries happen each year worldwide, while from the total neonatal deaths, about 99% of them take place in developing countries[4]. Perinatal asphyxia alone contributes to 42 million disability-adjusted neonatal life years lost and 23% of the deaths[9,10]. Approximately 3% of the 130 million newborns delivered each year globally develop severe consequences of birth injuries such as epilepsy, cerebral palsy, and developmental delay [11].

Evidence shows larger than the average birth weight of the fetus, small pelvis, small maternal stature, maternal obesity, and presence of maternal pelvic anomalies are the common maternal-related risk factors for birth injuries. Fetal macrosomia, pre-term or post-term delivery, and fetal mal-presentation are neonatal-related risk factors for birth injuries. Induction of labor, shoulder dystocia, and operative childbirth are the intrapartum-related risk factors of birth injuries[10,12].

Ethiopia achieved the millennium development goals for under-five death two years earlier than planned but it is less successful in reducing neonatal deaths. Limited studies in Ethiopia show, childbirth-related complications and/or birth injuries are among the major and direct causes of neonatal deaths[8,13]. However, there is a dearth of studies in this aspect. Therefore, this study aimed to assess the magnitude of neonatal birth injuries and their associated factors in public hospitals of Silte Zone, Central Ethiopia.

Materials and methods

Study area, population, study design, and period

The study was conducted in Silte Zone which is located in the Central Ethiopia. The Zone has 10 Districts and 3 administrative towns. Based on the information obtained from the Silte Zone Health Department, the population of the Silte Zone is estimated to be 1,033,954 in 2019. All women regardless of the mode of delivery and their neonates in Silte Zone were the source population and all women and neonates delivered at the included hospitals were taken as the study population. Neonates with major congenital malformations referred to the included hospitals during the data collection period were excluded. The multicenter facility-based cross-sectional study design was conducted from March to April 2021.

Sample size determination of the study

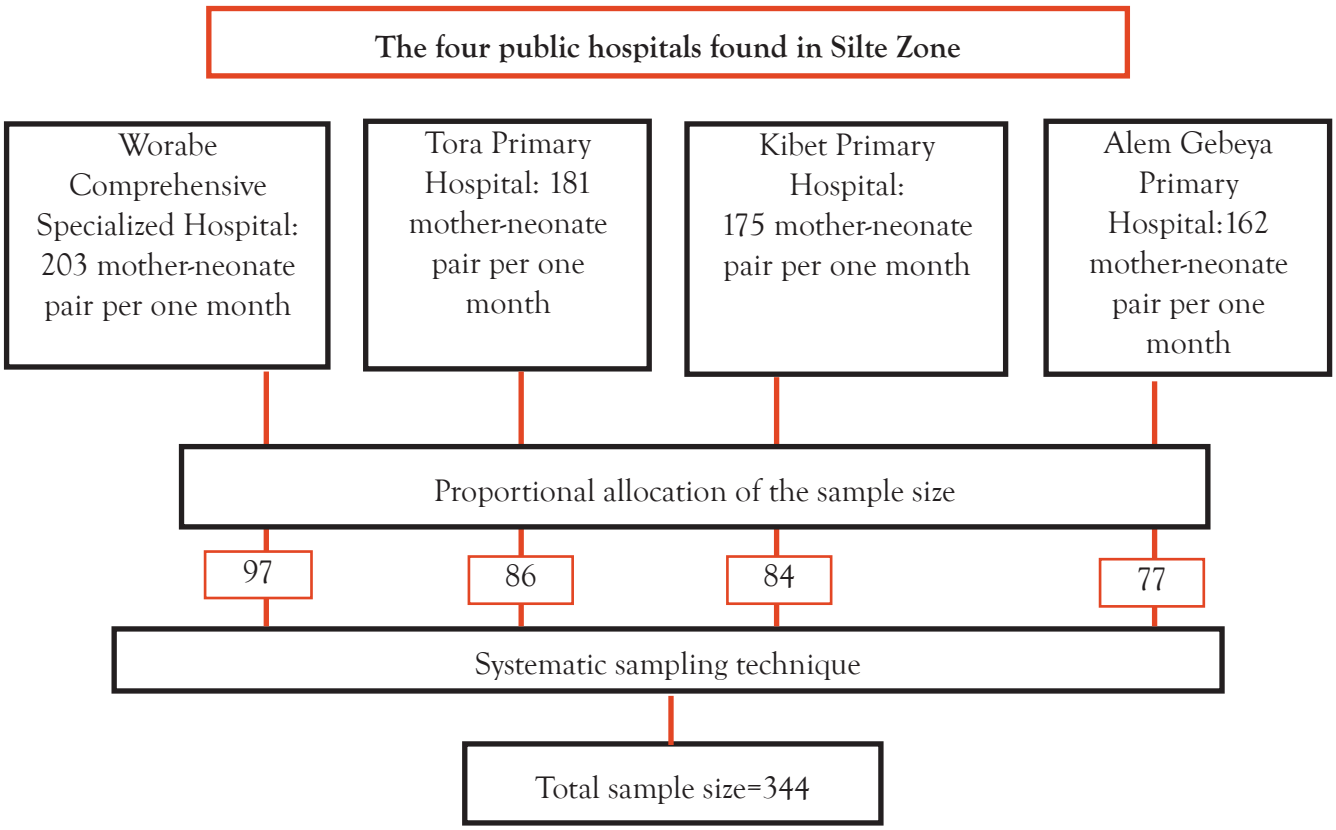
By using the single population proportion formula and considering the following sample size calculation assumptions: confidence level of Zα/2 of 95%, marginal of error 4%, a reasonable estimate for the proportion of birth injury from the study result of Jima, Southwest Ethiopia (P=0.154)[14] the sample size was calculated as follows:

$$n = \frac{(Z\ \alpha/2)^2 * P\ (1\text{-}P)}{d2} = \frac{(1.96)^2 * 0.154\ (1\text{-}\ 0.154)}{(0.04)^2} = 313$$

After adding 10% non-response, the final sample size was 344 mother-neonate pairs were included in the study.

The sampling procedure

All four public hospitals in the Silte Zone Worabe Comprehensive Specialized Hospital (WCSH), Kibet Primary Hospital (KPH), Tora Primary Hospital (TPH), and Alem Gebeya Primary Hospital (AGPH) were included in the study. Then proportionally allocation of the required calculated total sample size for each hospital was done considering the average number of labor and delivery service visits of one month before data collection: WCSH=203 per month, KPH=175 per month, TPH=181 per month, and AGPH=162 per month with a total of 721 per month in the four hospitals included. After proportionally allocating the required sample size to each hospital: WCSH=344x203/721=97, AGPH= 344x162/721=77, TPH=344x181/721 =86, and KPH = 344x175/721=84 and a systematic sampling technique with the sampling interval of two (721/344=2) was applied to select mother-neonate pairs 'Figure 1'.



Variables of the Study

Dependent variable: Birth injury on the neonates during childbirth.

Independent variables:

Maternal socio-demographic characteristics: age, educational status, residence, occupation, marital status

Maternal obstetrics and reproductive characteristics: gravidity, parity, the onset of labor, mode of delivery and ANC follow-up

Medical disorders and infection on the mother: chronic medical conditions like, Diabetes Mellitus (DM), cardiac disease

Maternal physical and lifestyle characteristics: Mid Upper Arm circumference (MUAC), substance use, physical activity

Neonatal factors: sex of the neonate, neonatal weight, fetal presentation, Apgar score

Data collection tool and procedures

Data were collected by face-to-face interviewer-administered and structured questionnaires, anthropometric measurements, and by reviewing the mother-neonate pair medical records to identify the type of birth injury encountered using checklists. The questionnaire consisting of information on sociodemographic and reproductive characteristics, morbidity status, different chronic maternal medical disorders, gynecologic and obstetric factors, and neonatal-related factors, and others were extracted from the literature review and used 'Supplementary files: Supplementary questionnaire 1'. The questionnaire was constructed in English and translated to the Amharic language and back to English to keep its consistency and equivalency. Six Midwifery professionals and 6 neonatal nurse professionals collected the required data.

Data quality management

The tool was evaluated and validated by senior researchers and subjects experts. Two days of training were given for data collectors. The pre-test was employed on 5% of the sample size in Halaba Kulito general hospital. Based on the pre-test result modification of the sequence of questions was done and vague terminologies were replaced with simple common words. Daily evaluation of the data collection process was monitored by the researchers. Data completeness and problems encountered during data collection were followed each day and the necessary correction was done accordingly.

Data processing and analysis

The completeness of the questionnaire was rechecked preceding data entry. Following this, data coding, entry, cleaning, recording, and analysis were accomplished by using SPSS version 25. Descriptive statistics were computed. Bivariable logistic regression analysis was done after dichotomizing the dependent variables with coding 1 for Yes and 0 for No. CORs and AOR were computed to assess the presence and degree of association between the dependent and independent variables. In the bivariable logistic regression analysis, the variables with P-value <0.25 were entered into a multivariable logistic regression analysis model to control confounding variables and to check the independent and significant association. A P-value of <0.05 with a 95% CI was used to express the strength and statistical association of the variables. The results were presented using text descriptions, tables, and graphs.

Operational definitions

Birth injury: a neonate who has been diagnosed with oxygen insufficiency for tissue (perinatal asphyxia/ birth asphyxia), mechanical birth trauma, or both encountered during childbirth.

Mechanical birth trauma: the presence of mechanical (physical) trauma of the soft tissue or organs of the newly borne neonate during labor and/or childbirth.

Perinatal asphyxia (birth asphyxia): a diagnosis made according to NICU management protocol of Ethiopia based on the failure to initiate and sustain breathing at birth, impairment of placental or pulmonary gas exchange leading to hypoxemia and hypercarbia (persistence of an APGAR score of less than 3 at 10^{th} minute and evidence of multi-organ (the brain, heart, lung, kidney, liver) dysfunction immediately following childbirth[8].

Results

Socio-demographic and economic characteristics of the study participant

A total of 344 (100%) response rate study respondents participated in the study. The mean age of respondents was 28 years, ranging from 17 to 43 years. More than 81% of the mothers were 20-35 years of age while 14.2% of them were aged greater than or equal to 35 years. The median family size of the respondents was 5. More than half of the respondents, 208 (60.5%) were rural residents and (48%) had no formal education. The majority, 319 (92.7%) were Muslims followed by Orthodox, 19 (5.5%). All of the study participants 344 (100%), were married and the majority 164 (47.7%) were housewives while 8 (22.7%) were merchants (Table 1).

Table 1: Socio-Demographic and Economic Characteristics of Study Participants in Silte Zone Public Hospitals, Central Ethiopia

Variables (n=344)		Frequency	
		Number	%
Age	<20 Years	16	4.7
	20-35 Years	279	81.1
	>=35 Years	49	14.2
Religion	Muslim	319	92.7
	Orthodox	19	5.5
	Protestant	6	1.7
Occupation	Housewife	164	47.7
	Government employee	45	13.1
	Self-employed	37	10.8
	Merchant	78	22.7
	Farmer	20	5.8
Education status	Not attend formal education	165	48
	Attend primary education	95	27.6
	Attend secondary education	40	11.6
	Attend more than 2ry education	44	12.8
Marital status	Single/not married	27	6.4
	Married	372	88.2
	Divorced/ Widowed	11	2.6
Ethnicity	Silte	322	93.6
	Gurage	10	2.9
	Hadiya	7	2
	Amhara	5	1.5
Residence	Urban	136	39.5
	Rural	208	60.5
	< 5 members	168	48.8
	≥5 members	176	51.2

Maternal obstetrics and reproductive characteristics

The majority of mothers 265 (77%) were multiparous and the rest 79 (23%) were primiparous. More than half (54.9 %) of the participants had less than 4 ANC follow-up care visits by healthcare professionals. Approximately 21.2% of mothers were diagnosed with mal-presentation of the fetus. About 23 % of the study participants had complications during their previous childbirth.

Mode of delivery of the study participants

The majority of mothers 70.6% childbirth was Spontaneous Vaginal Delivery (SVD), 14.5% of them by Cesarean Section (C/S), and the reaming 14.8 % gave childbirth was assisted SVD 'Figure 2'.

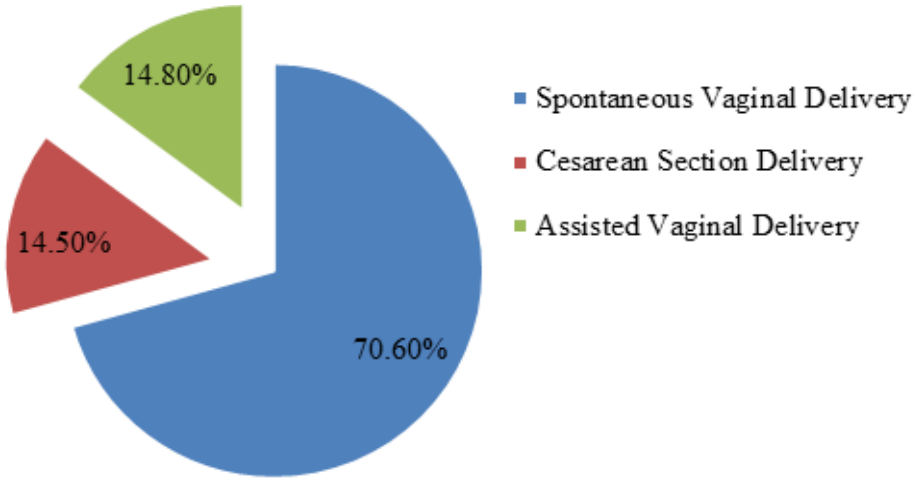


Figure 2

The neonatal characteristics

The majority 61% of the neonates were males. Low birth weight was observed in 9% of the neonates and 1.2% were macrocosmic. The proportion of preterm babies was 13.1% and post-term accounted 2.9%. Nearly twenty-three (22.7 %) of neonates had low (0-3), 18.9% had moderate (4-6) and the remaining 58.4 % had mild APGAR score.

The magnitude of birth injuries

The magnitude of birth injuries in the current study was found to be 24.7% (95% CI=24.7%-24.8%). Approximately 2.9 % of neonates had birth asphyxia and physical trauma while 16.6 % of the neonates had birth asphyxia (perinatal asphyxia). The majority 71.6 % and 6 % of the neonates had been affected with soft tissues and scalp injuries respectively while 3.6 % of them had fractures 'Figure 3'.

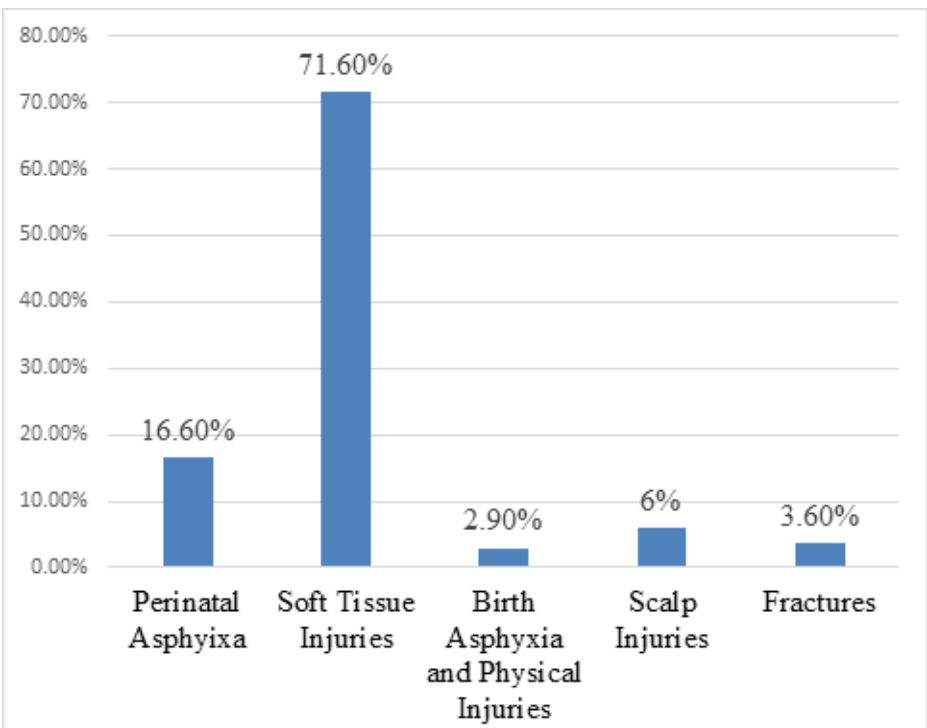


Figure 3

Factors associated with birth injury in selected public hospitals of Silte Zone, Central Ethiopia.

Bivariable logistic regression analysis was conducted to identify the possible associated factors with birth injury. In the current study, residence (COR=2.64, 95% CI= 1.51-4.61), (source of referral (COR=0.72 , 95% CI= 0.44-1.20), history of pre-term (COR=13.82, 95% CI=3.72-51.2), gestational age (COR=0.603, 95% CI = 0.30-1.20), ANC follow-up (COR=1.944, 95% CI=1.13-3.33), mode of delivery (COR=0.51, 95% CI =0.88-2.87), history of obstetric complications (COR=0.2.16 ,95% CI =1.25-3.74), maternal height (COR=5.63, 95% CI=2.43-12.5), birth weight (COR=0.06 ,95% CI=0.03-0.13) , fetal presentation (COR=17.86, 95% CI=9.57-33.33) were associated with birth injury in the binary logistic regression analysis.

ANC follow–up by health professionals less than four (AOR=3.2, 95% CI = 1.21-8.33), short maternal height (AOR=4.85,95% CI= 1.26-20), assisted childbirth (AOR =3.33, 95 % CI=1.003 -11.044) and fetal mal-presentations (AOR=29.69, 95% CI =10.61 - 43.09) were significantly and independently associated with birth injury in multivariable logistic regression analysis (Table 2).

Table 2: Bivariate and Multivariate Analysis of Birth Injury with Maternal, Pregnancy, and Labor Related Factors In Silte Zone Public Hospitals, June 2021.

Variables		Birth Injury		COR	AOR
		No	Yes	95%CI	95%CI
Residence	Urban	116 (85.3%)	20 (14.7%)	1	1
	Rural	143 (68.8%)	65 (31.3%)	2.64 (1.51-4.61)	2.47(0.936-6.556)
Source of Referral	Self	141 (72.7%)	53 (27.3%)	1	
	Other HF	118 (78.7%)	32 (21.3%)	0.72(0.44-1.20)	0.732(0.289-1.849)
History of Preterm birth	No	211 (79%)	56 (21%)	1	1
	Yes	3 (21.4%)	11 (78.6%)	13.82(3.73-51.2)	5.143(0/673-39.312)
Gestational age(weeks)	<37	30 (66.7%)	15 (33.3%)	0.603(0.30-1.20)	0.902(0.258-3.148)
	37-40	199 (76.8%)	60 (23.2%)	1	1
	41-42	30 (75%)	10 (25%)	0.67(0.26-1.72)	0.429(0.065-2.853)
ANC follow up	>=4	117 (82.4%)	25 (17.6%)	1	1
	<4	130 (70%)	54 (29.3%)	1.944 (1.13-3.33)	3.2 (1.21-8.33)
Mode of delivery currnt birth	SVD	137 (79.2%)	36 (20.8%)	1	1
	Assisted	50 (71.4%)	20 (28.6%)	1.52(0.81-2.87)	3.33(1.003-11.044)
	C/S	72 (71.3%)	29 (28.7%)	1.53(0.87-2.7)	2.212(0.768-6.371
History of obstetric complication	No	211 (78.7%)	57 (21.3%)	1	1
	Yes	48 (63.2%)	28 (36.8%)	2.16(1.25-3.74)	1.478(0.528-4.139)
Maternal height	>154cm	248 (78.5%)	68 (21.5%)	1	1
	<154cm	11 (39.3%)	17 (60.7%)	5.63 (2.43-12.5)	4.85 (1.26-20)
Birth weight	<2500gm	11 (25.6%)	32 (74.4%)	0.06(0.03-0.13)	0.46(0.013-0.16)
	2500 -3999gm	234 (85.1%)	41 (14.9%)	1	1
	>=4000gm	14 (53.8%)	12 (46.2%)	0.295(0.11-0.83)	0.308(0.058-1.623)
Fetal presentation	Vertex	238 (87.8%)	33 (12.2%)	1	1
	Non-vertex	21 (28.8%)	52 (71.2%)	17.86(9.57-33.33)	29.69(10.61-83.09)

Footnote: COR=Crude Odds Ratio, AOR=Adjusted Odds Ratio, CI=Confidence Interval, HF=Heart Failure

DISCUSSION

The magnitude of birth injury in the current study is 24.7% (95% CI=24.7%-24.8%) in this study is higher than the study reports of some developing countries[13,15,16] including the study done in Jimma University specialized hospital and tertiary hospitals of Addis Ababa, Ethiopia where15.4 % and 12.3 % of the neonates had birth injuries respectively[14,17]. The possible reason for this variation might be due to the differences in the competency and experience of health professionals, local intrapartum management protocols, routinre immediate neonatal examination protocols (policies), sample size, study design, and the time-lapse between the studies.

Perinatal asphyxia or birth asphyxia alone in the current study contributed to 16.6 % of birth injuries. This finding is higher than the study report of Jima University specialize hospital where 8.1 % of the neonates sustained birth asphyxia from the total birth injuries of 15.4%[14]. This result is also higher than the study reports of New Delhi 3.6 % [9] and, Uganda referral hospital 12.8 %[6,18]. The dissimilarities of the findings might be due to the differences in the socio-demographic and socio-economic factors, quality of the service delivered during prenatal, labor, and childbirth, and the availability, accessibility, and affordability of maternal service, competency and experience of health professionals, local intrapartum management protocols, routinre immediate neonatal examination protocols (policies).

In the current study birth trauma accounts for 71.6% of the reported total birth injuries.The finding was unacceptabley high when compered to a systematic review and meta analysis result in Ethiopia where neonatal birth trauma among newborns in Ethiopia was 15%[19]. The possible reason for the variation might be the type and the scope of the studies

The previous finding of the recent study is lower than the study finding of Zambia where perinatal asphyxia magnitude of 23 %[20]. The discrepancies might be due to the differences in the characteristics of the study population, sample size, the time lapse between the two studies, and the study settings.

The present study confirmed that neonates who were born from mothers of ANC follow-up less than four (AOR=3.2, 95% CI = 1.21-8.33) had a higher risk of encountering a birth injury than their counterparts. This finding was similar to the study findings from Hungary[21], but not with the study finding of Jimma University specialized hospital, and tertiary hospitals of Addis Ababa, Ethiopia where ANC follow up less than four times was not reported to have association with birth injuries [14,17,22,23].

Neonates borne by assisted vaginal childbirth had a 3.3 (AOR=3.3, 95% CI=1.003-11.044) times the high risk of getting injury than those delivered spontaneously. This finding is similar to the study done in Dessie town, Ethiopia 24. Neonates borne from mothers who had a history of obstetric complications had 1.5 times (AOR=1.5, 95% CI=0.528-4.139) more chance of sustaining birth injuries than those mothers without obstetric complications. This finding is congruent to the study finding of Chennai, India[15].

According to this study, a short maternal height of <154 cm (AOR=4.85,95% CI= 1.26-20) was more risk for birth injury of the neonates than their counterparts. A similar report was found in the study done in Dessie town, Ethiopia, and the study in tertiary care hospitals of Chennai, India, and Nigeria[15,24,25].

The risk of birth injury was also significantly high among neonates of assisted childbirth (AOR =3.33, 95 % CI=1.003 -11.044) and fetal mal-presentation (AOR =5.78, 95 % CI=1.99 -16.78). These results are reported similarly in the studies conducted in Jimma university specialized hospital, Ethiopia and a prospective study done in Chennai, India 14,15. Unlike many other studies from low and middle-income countries, in this study, length of labor, primiparity, sex of the neonates, maternal weight, and MUAC had no association with a birth injury [2,22,24,26,27].

LIMITATIONS

The limitations of the present study include the result of the current study might not be

generalized to the whole population since this study was conducted at the health care facilities level. Additionally, this was done using only the quantitative approach, it would have been more informative if it included a qualitative approach. Finally, as the study was conducted in primary and referral hospitals most of the childbirth might be referral cases and this might be the reason for the slightly increased magnitude of birth injury relative to other studies in Ethiopia.

CONCLUSIONS

The magnitude of birth injury in this study was higher than other similar studies done in developing countries. Birth injuries were significantly high among neonates of mothers who attended less than four ANC follow-up visits, assisted birth / instrumental deliveries, neonates of mothers with short maternal height, and neonates with fetal mal-presentations. Therefore; efforts should be made to improve the quality of prenatal and intrapartum care services to prevent birth injuries. Improving the referral system and strengthening the capacity of health professionals are recommended.

Abbreviations

ANC: Antenatal Care,
AGPH: AlemGebeya Primary Hospital,
APH: Ante Partum Hemorrhage,
C/S: Cesarean Section,
DM: Diabetic Mellitus,
KPH: Kibet Primary Hospital,
MUAC: Mid-Upper Arm Circumference,
NICU: Neonatal Intensive Care Unit,
SVD: Spontaneous Vaginal Delivery,
TPH: Tora Primary Hospital,
WHO: World Health Organization and
WCSH: Worabe Comprehensive Specialized Hospital

Ethical Consideration

This study was conducted following the declaration of Helsinki for studies involving human participants. Ethics approval was obtained from the Institutional Review Board (IRB) of Wolaita Sodo University. Permission was secured from Silte Zone Health Department, District Health Offices, and the leaders of respective Hospitals sequentially. The purpose and procedure of the study were explained to respective health officials "Supplementary files: Supplementary information 1". After getting permission from the medical director, obstetrics and gynecologic and pediatric departments of the hospitals, they have been requested to confirm the applicability of this study and to write a letter of cooperation to the delivery case team and NICU, and medical record office of the respective hospital. Finally, the researchers obtained informed written consent from all mothers/guardians after an agreement has been reached to participate in the study "Supplementary files: Supplementary information 2".

Consent for Publication: Not applicable

Data availability: The dataset analyzed for the findings of this particular study is available with the corresponding author and can be accessed upon reasonable request.

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Competing interests: The authors declared that they have no competing interests

Authors contribution

All authors equally contributed to this work beginning from the conception, study design, execution, acquisition of data, analysis, and interpretation. Authors of this work took part in the drafting, revising, and/or critically reviewing of the article and finally agreed on the journal to which the article was submitted. All authors are also reviewed and agreed on all versions of the article before submission, during revision, and the final version is accepted for publication and agreed to be accountable for all aspects of the work.

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SUCCENTURIATE LOBE OF PLACENTA WITH VASA PREVIA: A CASE REPORT OF PRENATAL DIAGNOSIS

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ABSTRACT

BACKGROUND: Succenturiate placenta is rarely diagnosed prenatally. When succenturiate lobes are present, they may be associated with vasa previa, which can cause dangerous fetal hemorrhage during delivery. Antenatal diagnosis is crucial to prevent fetal death and morbidity.

CASE PRESENTATION: A 34-year-old Gravida-III, Para-I, A-I mother underwent an elective cesarean section at 34 weeks of gestation due to vasa previa, resulting in a good fetal and maternal outcome. Diagnosis of vasa previa and succenturiate placenta was achieved using Doppler ultrasound.

CONCLUSION: Prenatal diagnosis of succenturiate placenta is essential to prevent fetal death and significant maternal morbidity, such as postpartum hemorrhage. Doppler ultrasound is crucial for achieving this goal.

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INTRODUCTION

Antenatal diagnosis of succenturiate placenta is crucial because vessels connecting the main placenta with the succenturiate placenta may rupture during labor, potentially leading to fetal death. Additionally, retention of placental material can result in postpartum hemorrhage.[1] We report a case of succenturiate placenta diagnosed prenatally, for which an elective cesarean delivery was performed at 34 weeks of gestation.

CASE PRESENTATION

A 34-year-old Gravida-III, Para-I, A-I mother was admitted to the high-risk ward at 28 weeks of gestation (based on an ultrasound at 8+4 weeks) with a diagnosis of low placenta and early preterm pregnancy, pending exclusion of vasa previa for conservative management. An earlier anatomy scan at 25 weeks showed no anomalies but revealed a posterior low-lying placenta with a small anterior placental segment.

Following admission, dexamethasone was administered for fetal lung maturity, and conservative management with biweekly biophysical profiles and non-stress tests continued. After 5 weeks, at 33 weeks of gestation, an obstetric and Doppler ultrasound by a maternal-fetal medicine specialist documented vasa previa and a posterior bulk placenta connected to an anterior accessory lobe via blood vessels. A diagnosis of succenturiate placenta was suspected, and the decision was made to deliver the baby via elective cesarean section at 34 weeks of gestation. Cesarean delivery was performed as planned, resulting in a live 2325-gram male baby with Apgar scores of 7/10 and 8/10 at the first and fifth minutes, respectively. Examination of the placenta confirmed a succenturiate placenta with a posterior bulk and an anterior accessory lobe connected by a membrane with transverse blood vessels. The mother was discharged 3 days post-operatively with a healthy baby. Follow-up a week later showed no abnormalities and good wound healing.

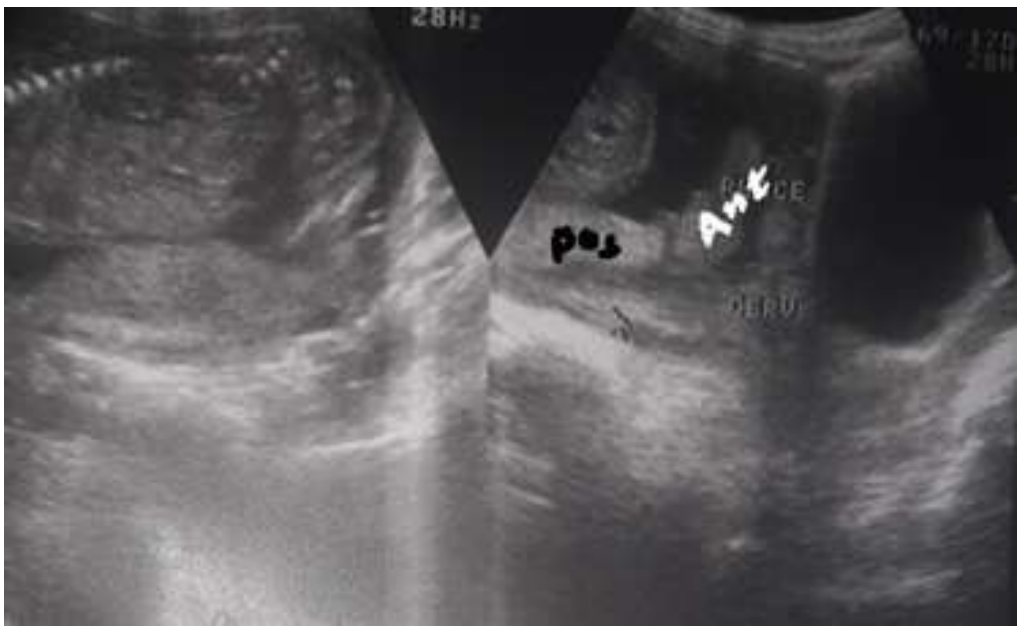

Figure 1. Ultrasound findings: Pos written in black represents the posterior bulk of the placenta and Ant written in white represents the accessory lobe of placenta.

Figure 2: Placenta findings at delivery: a succenturiate placenta with a posterior bulk and an anterior accessory lobe connected to the bulk by a membrane with transverse blood vessels.

DISCUSSION

Succenturiate placenta is characterized by one or more small accessory lobes connected to the main placental body by vessels of fetal origin.[1] Advanced maternal age and in vitro fertilization are considered risk factors, likely due to the underlying progressive vascular damage associated with these conditions.[2,3] The diagnosis is typically made at birth, with very few prenatal diagnoses reported. Prenatal diagnosis requires meticulous ultrasound evaluation by an experienced sonographer, as vessels between the parts can mimic an amniotic band or uterine septum. Color Doppler imaging plays a crucial role in establishing the correct diagnosis, as evidenced in our case, sometimes supported by recent technologies like B-flow.[4,5] Transabdominal color Doppler imaging of floating vessels in the amniotic cavity, connecting the anterior placenta to the posterior lobe, and showing a venous type with its spectral waveform, is typical. This anomaly should be differentiated from a bipartite or bilobed placenta, which consists of two placentas of equal or near-equal size separated by a membrane.[6]

Some studies suggest that succenturiate lobes can cause sudden fetal death, especially if vessels cross the cervical os, leading to vasa previa.[7-10] In our case, vasa previa was diagnosed with Doppler ultrasound, and a safe elective cesarean section at 34 weeks of gestation resulted in a good outcome (the baby was delivered alive with a good Apgar score). Preparation was made for possible blood transfusion and postpartum hemorrhage, but there was no such complication..

CONCLUSIONS

Prenatal diagnosis of succenturiate placenta is essential to prevent fetal death and significant maternal morbidity (postpartum hemorrhage). Doppler ultrasound is essential for detecting vasa previa prenatally, enabling optimal conservative management and preparation for delivery.

DECLARATIONS

Ethics Approval and consent to participate

A written informed consent was obtained from the patient for publication of this case.

Availability of supporting data

All supporting documents are submitted along with the case report

Competing interests

No competing interests

Authors' contributions

AF and MM contributed the introduction and case. AFS, WG and MF prepared the discussion and conclusion part. The final manuscript was approved by all authors for publication.

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MONTHLY BLEEDING UMBILICAL ENDOMETRIOSIS: CASE REPORT

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ABSTRACT

BACKGROUND: Umbilical endometriosis is a rare condition characterized by the presence of endometrial-like tissue in or around the umbilicus. This case report aims to highlight the unusual presentation of endometriosis in the umbilical region and review its surgical management.

CASE PRESENTATION: A 20-year-old patient presented with monthly bleeding and painful umbilical swelling for the past four months. She had never been pregnant and had no history of pelvic surgery.

INTERVENTION AND OUTCOME: The umbilical lesion was excised, and the umbilicus was reconstructed. Histological examination confirmed the diagnosis. The patient was followed for three months post-surgery and reported no further complaints about her umbilical area.

CONCLUSION: Umbilical endometriosis is a rare disease but should be considered in the differential diagnosis of umbilical lesions with bleeding in women of reproductive age. Excision with umbilical reconstruction has a favorable outcome.

KEYWORDS: Endometriosis, Umbilicus, Case Report

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INTRODUCTION

Endometriosis is defined as the presence of endometrial tissue (glands and stroma) outside the uterine cavity, affecting 5 to 10% of fertile women.[1] It is a chronic disease associated with severe, disturbing pain during menstrual bleeding, sexual intercourse, chronic pelvic pain, and infertility.[2-5] Abdominal wall endometriosis is among the most common extrapelvic endometriosis, occurring at distant sites from the reproductive organs.[6] Umbilical endometriosis, first described in 1886 by Villar, is defined as endometrial-like tissue within the umbilicus. It is rare, with a reported incidence of 0.5%-1% of all endometriosis, 0.4%-4% of extragenital cases, and 21% of abdominal wall endometriosis. [7-9]

Endometriosis in atypical locations is explained by the theory of retrograde menstruation, where migrating cells implant in pelvic organs, most commonly the ovary and uterosacral ligament area. Umbilical endometriosis can be classified as primary and secondary, with the inciting event in secondary type and primary umbilical endometriosis not well elucidated. According to a systematic review, most umbilical endometriosis cases are primary, accounting for 70% of cases. Since the nodule is estrogen-dependent, women of reproductive age are affected.[10-15]

The common clinical presentation of umbilical endometriosis includes red, purple, or black umbilical nodules causing pain, swelling, and bleeding in the umbilical area in every menstrual cycle. [5, 8, 12, 16]

The diagnosis of umbilical endometriosis is suspected clinically and confirmed with histology after surgical excision. The management principle in umbilical endometriosis is radical surgery with wide excision.[12-14, 17]

This case study presents the clinical course of a patient with monthly bleeding umbilical endometriosis, detailing the diagnostic journey, therapeutic interventions, and outcomes. By discussing this rare manifestation, we aim to enhance awareness among clinicians and contribute to the understanding and management of extrapelvic endometriosis.

Understanding such cases is crucial for early recognition, appropriate management, and improved outcomes for patients presenting with unusual symptoms of endometriosis beyond conventional sites.

CASE PRESENTATION

A 20-year-old nulligravida patient presented with swelling over the umbilicus for the past four months. Associated with the swelling, she had dark red, non-clotting bleeding from the mass, starting on the first day of her menstrual cycle each month. She experienced severe pain in the swelling for two days before the bleeding started, which then decreased. She had no lower abdominal or pelvic pain except for mild abdominal discomfort during the first two days of her menses. She had no vulvar swelling and no pain during sexual intercourse. Her menstrual cycles were regular, occurring every 28 days and lasting for five days. She had no history of surgery and no bleeding from other body sites. She had no plans for conception and had an Implanon implant in her left arm for the past three years. There was no family history of the same problem.

On physical examination, there was a 2 by 3 cm soft, dark-colored umbilical mass, which was non-tender (Fig. 1). There were no abnormal results on pelvic examination.

Figure 1. Umblical mass before surgery (a) and removed tissue after surgery (b)

The abdominal-pelvic ultrasound reveals normal findings in the uterus, adnexa and pelvic peritoneum and there was a 1.5 cm by 1 cm well-defined hypo-echoic solid lesion in the anterior abdominal wall above the linea Alba with no communication to the peritoneal cav

MANAGEMENT AND OUTCOME

The patient was evaluated by an anesthetist, and mass excision with umbilical reconstruction was performed under spinal anesthesia (Fig. 1.b). Histopathology results revealed surface squamous epithelium with endometrial-type glands and stroma beneath.

She was seen a week after surgery and had a normally healing wound. Over the next three months of follow-up, there were no complaints and no recurrence at the scar site.

DISCUSSION

Extrapelvic endometriosis can involve almost every organ in the human body, with a mean age of presentation of 34 years. It was first described by Villar in 1886 and is known as Villar's nodule.[1, 18]

The pathogenesis of endometriosis is not entirely clear. The most widely accepted assumption is retrograde menstruation into the abdominal cavity, described by Sampson in 1927, and supported by several clinical observations.[3,19] Another theory is the transformation of mesothelium to endometrium-like tissue under the influence of regurgitated endometrium (the induction theory). This "coelomic metaplasia" theory is based on the observation that coelomic epithelium can differentiate into both endometrial and peritoneal cells.[20] Additionally, the differentiation of Müllerian remnants into endometrial tissue has been suggested. Lastly, an impaired immune response, such as decreased natural killer cell activity, may diminish the clearance of endometrial cells from the peritoneal cavity, leading to endometriotic lesion development.[21, 22]

For umbilical endometriosis, the implantation of intra-abdominal endometrial cells likely occurs through lymphatic or vascular spread or by dislocating endometrial tissue during surgeries, such as laparoscopic procedures. These routes explain the occurrence of endometriosis at distant locations.[23, 24]

In the development of spontaneous umbilical endometriosis, as in the presented case, it is possible that the umbilicus acts as a physiological scar with a predilection for endometrial tissue.[25]

The clinical diagnosis of umbilical endometriosis can be challenging. The mass in our case was nearly black, resembling a pigmented tumor. Umbilical endometriosis has been described as flesh-colored, brownish, dark-bluish, or simply a subcutaneous

mass.[18, 26-28] Because of its variable macroscopic appearance, these lesions can initially be confused with malignant tumors such as melanoma. However, conditions presenting with a subcutaneous mass or discoloration of the umbilical skin, such as a benign nevus, lipoma, abscess, cyst, hernia, or metastatic deposit from a malignancy, should also be considered.[29, 30]

Various systematic reviews, case series, and reports describe umbilical endometriosis as a problem of reproductive age, commonly presenting as an umbilical mass that increases in size periodically and bleeds with menstruation. Our case aligns with these reports.[6, 7, 15, 17]

To aid the diagnosis of cutaneous endometriosis, the use of dermoscopy 31, MRI25, and high-frequency power Doppler 32 is recommended. It is generally advised that umbilical endometriosis be removed surgically.[2, 4, 27] Histology will confirm the diagnosis. In our case, the diagnosis was made clinically, aided by ultrasound findings, and confirmed by histological examination revealing typical ectopic endometrial tissue similar to other cases in the literature. Given the possibility of recurrence, the patient was counseled for follow-up. No mass was found in the umbilical area three months post-surgery.[33, 34]

As this is a case report, the variety of clinical presentations may not be revealed. The short follow-up period also limits the ability to detect possible recurrence or evidence of endometriosis at other sites.

CONCLUSION

Umbilical endometriosis is a very rare disease but should be considered in the differential diagnosis of umbilical lesions. Clinical diagnosis is challenging due to the presence of other benign and malignant umbilical skin lesions. Diagnosis should be supported by imaging, such as ultrasound, to examine the extent of lesion involvement and identify other endometriotic lesions in the abdomen and pelvis. Surgical excision is the treatment of choice. Follow-up is recommended to monitor for possible recurrence.

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Authors' contributions

AWM, DMA, and GDA took the history, performed physical examinations, and conducted the operation. AWM wrote the manuscript. All authors read, reviewed, and approved the manuscript before submission.

Ethics approval and consent to participate

The case study was conducted following the Helsinki Declaration and Ethiopian National Research Ethics Guideline. Informed consent was obtained from the patient. Additionally, the Bahir Dar University College of Medicine and Public Health Sciences Institutional Review Board granted ethical clearance to publish this case report (protocol number 536/2022).

Consent for publication

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests

The authors declare that they have no competing interests.

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INSTRUCTION TO AUTHORS

1. Type of Articles

The Ethiopian Journal of Reproductive Health (EJRH) publishes original articles, review articles, short reports, program briefs, and commentaries on reproductive health issues in Ethiopia, and the African region. EJRH aims at creating a forum for the reproductive health community to disseminate best practices, and relevant information on reproductive health.

Original Articles: Articles reporting on original research using quantitative and/or qualitative studies could be submitted to EJRH.

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2. Uniform Requirements

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Title page: The title page should have title of the article; name of each author and institutional affiliation, and address of the corresponding author.

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