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Effectiveness and Acceptability of Copper and Levonorgestrel-Releasing Intrauterine Devices: A Comparative Observational Study

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ABSTRACT

Background: Intrauterine devices (IUDs) are among the most effective long-acting reversible contraceptive methods. Copper-bearing IUDs (Cu-IUDs) provide hormone-free contraception, whereas levonorgestrel-releasing intrauterine devices (LNG-IUDs) provide long-term contraception through the local release of levonorgestrel. The two methods differ particularly in their effects on menstrual bleeding and dysmenorrhea. ***Aim:*** The study aimed to compare the contraceptive effectiveness, menstrual outcomes, complications, and patient satisfaction associated with Copper-IUD and LNG-IUD use. ***Materials and Methods:*** A comparative observational study was conducted among 200 IUD users divided equally into two groups: 100 Copper-IUD users and 100 LNG-IUD users. Outcomes evaluated included pregnancy, device expulsion, pelvic infection, increased menstrual bleeding, dysmenorrhea, and patient satisfaction. Categorical data were expressed as frequencies and percentages. Fisher's exact test was used for low-frequency outcomes, while Pearson's chi-square test was applied to other categorical variables. A P value < 0.05 was considered statistically significant. ***Results:*** Of the 200 participants, 127 (63.5%) were aged ≥40 years. Pregnancy occurred in one Copper-IUD user (1.0%) and no LNG-IUD users ($P = 1.000$). Device expulsion occurred in 6.0% and 3.0% of Copper-IUD and LNG-IUD users, respectively ($P = 0.498$), while pelvic infection occurred in 3.0% and 2.0%, respectively ($P = 1.000$). Increased menstrual bleeding was significantly more common among Copper-IUD users than LNG-IUD users (32.0% vs. 8.0%, $P < 0.001$). Dysmenorrhea was also significantly more frequent in the Copper-IUD group (28.0% vs. 10.0%, $P = 0.001$). Patient satisfaction was 82.0% among Copper-IUD users and 91.0% among LNG-IUD users ($P = 0.063$). ***Conclusion:*** Both IUD types demonstrated high contraceptive effectiveness and low complication rates. LNG-IUD users experienced significantly less increased menstrual bleeding and dysmenorrhea. Individual preferences, menstrual characteristics, reproductive goals, and medical eligibility should be considered when selecting an IUD.

Keywords: Intrauterine device, Copper-IUD, levonorgestrel, LNG-IUD, contraception, menstrual bleeding, dysmenorrhea, patient satisfaction.

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1. INTRODUCTION

Family planning is an essential component of reproductive healthcare and plays a major role in preventing unintended pregnancies, improving birth spacing, and supporting maternal and child health. Although several effective contraceptive methods are available, their real-world effectiveness may be influenced by adherence, accessibility, adverse effects, individual preferences, and the need for repeated or daily use. Long-acting reversible contraceptives (LARCs) overcome many of these limitations by providing highly effective and prolonged contraception with minimal ongoing action from the user [1-4].

Intrauterine devices (IUDs) are among the most effective forms of reversible contraception currently available. Their high effectiveness, long duration of action, and rapid reversibility make them suitable for individuals who desire reliable contraception without daily adherence [4-7]. Large prospective studies have demonstrated substantially lower contraceptive failure rates with long-acting reversible methods compared with shorter-acting user-dependent contraceptives [31-33].

The two principal categories of intrauterine contraception are copper-bearing intrauterine devices (Cu-IUDs) and levonorgestrel-releasing intrauterine devices (LNG-IUDs). Copper-IUDs provide long-term, hormone-free contraception, whereas LNG-IUDs continuously release a small amount of levonorgestrel within the uterine cavity [4-8]. Both methods are highly effective, although they differ considerably in their effects on menstrual bleeding, dysmenorrhea, and other non-contraceptive outcomes [8-11].

Copper-IUDs primarily exert their contraceptive effect by creating an intrauterine environment that interferes with sperm function and fertilization. Their absence of hormonal exposure makes

them particularly useful for individuals who prefer or require non-hormonal contraception [5,6,9]. Copper-IUDs also have an established role in emergency contraception and can provide continued long-term contraception after emergency insertion [16,17].

LNG-IUDs act predominantly through local progestogenic effects, including thickening of cervical mucus, alteration of sperm function, and suppression of the endometrium [8,23-25]. The endometrial effect of levonorgestrel also provides important non-contraceptive benefits. LNG-IUD use is associated with reduced menstrual blood loss and improvement in dysmenorrhea and may therefore be particularly beneficial for individuals experiencing heavy or painful menstruation [11,36,38,39].

One of the major clinical differences between Copper-IUDs and LNG-IUDs concerns their effects on menstrual patterns. Copper-IUD users may experience increased menstrual bleeding, prolonged menstruation, or greater menstrual cramping, particularly during the initial months following insertion [9,23,24]. In contrast, LNG-IUDs generally decrease menstrual blood loss over time, although irregular bleeding or spotting may occur during the early period after insertion [8,25,36,37]. These differences are important because changes in menstrual patterns can affect acceptability, satisfaction, continuation, and eventual discontinuation of contraception [32,33].

Despite their established contraceptive effectiveness, concerns regarding insertion-related pain, pelvic inflammatory disease, device expulsion, uterine perforation, and subsequent fertility may influence acceptance of IUDs. Available evidence indicates that serious complications are uncommon when appropriate patient selection and correct insertion techniques are employed [13-15,21,22,27]. The risk of pelvic infection is particularly related to the presence of sexually transmitted infection around the time of insertion rather than to prolonged use of the IUD itself [14,21,22].

Device expulsion represents another clinically relevant concern. Expulsion rates can vary according to patient characteristics, age, parity, timing of insertion, and clinical circumstances [13,27,29]. Postpartum and post-abortion insertion may offer important advantages in terms of immediate contraceptive access, although the timing of insertion needs to be considered when counseling patients regarding expulsion risk [34,35].

Uterine perforation is a rare but potentially serious complication of IUD insertion. Large observational studies have shown that the absolute risk remains low, although certain circumstances surrounding insertion may modify that risk [27,28]. Appropriate provider training, careful assessment before insertion, and recognition of individual risk factors remain important components of safe IUD provision.

Patient satisfaction and continuation are equally important considerations when evaluating contraceptive methods. High continuation and satisfaction rates have been demonstrated among users of long-acting reversible contraceptives [31-33]. Satisfaction may depend not only on contraceptive effectiveness but also on bleeding patterns, pain, adverse effects, expectations before insertion, quality of counseling, and compatibility of the selected method with an individual's reproductive preferences.

The availability of both Copper-IUDs and LNG-IUDs therefore allows intrauterine contraception to be individualized. Copper-IUDs may be preferred by individuals seeking a hormone-free method, while LNG-IUDs may offer additional advantages for individuals concerned about heavy menstrual bleeding or dysmenorrhea [8,9,38-40]. Evidence-based counseling and shared decision-making are essential to ensure that patients understand the benefits and potential disadvantages of each method [1-3,12,13].

Against this background, the present study was undertaken to compare Copper-IUD and LNG-IUD users with respect to contraceptive effectiveness, menstrual outcomes, complications, and patient satisfaction. Particular attention was given to pregnancy, device expulsion, pelvic infection, increased menstrual bleeding, dysmenorrhea, and overall satisfaction.

2. AIM AND OBJECTIVES

2.1 Aim

The present study aimed to compare the contraceptive effectiveness, menstrual changes, complications, and patient satisfaction associated with Copper-IUD and LNG-IUD use.

2.2 Objectives

The specific objectives were to:

1. Compare pregnancy rates between Copper-IUD and LNG-IUD users.
2. Compare the frequency of device expulsion and pelvic infection.
3. Assess differences in increased menstrual bleeding.
4. Compare the occurrence of dysmenorrhea.
5. Evaluate patient satisfaction with the two contraceptive methods.
6. Describe the age distribution of the study participants.

3. MATERIALS AND METHODS

3.1 Study Design

A comparative observational study was conducted to evaluate clinical and menstrual outcomes among Copper-IUD and LNG-IUD users.

3.2 Study Population

The study included a total of **200 IUD users**. Participants were divided into two equal groups:

- **Group I:** 100 Copper-IUD users
- **Group II:** 100 LNG-IUD users

3.3 Outcome Variables

The principal outcomes evaluated were:

- Pregnancy
- Device Expulsion
- Pelvic Infection
- Increased Menstrual Bleeding
- Dysmenorrhea
- Patient Satisfaction

3.4 Statistical Analysis

Categorical variables were expressed as frequencies and percentages. Fisher's exact test was used when event frequencies were low, particularly for pregnancy, device expulsion, and pelvic infection. Pearson's chi-square test was used for comparisons of increased menstrual bleeding, dysmenorrhea, and patient satisfaction. A two-sided P value < 0.05 was considered statistically significant.

4. RESULTS

4.1 Age Distribution

A total of 200 participants were included. The majority were aged 40 years or older.

Table 1. Age Distribution of Study Participants

Age group (years)	Number of participants (n)	Percentage (%)
18–24	6	3.0
25–29	11	5.5
30–34	17	8.5
35–39	39	19.5
≥40	127	63.5
Total	**200**	**100.0**

Participants aged ≥40 years represented the largest group, accounting for 127 (63.5%) of the study population. This was followed by participants aged 35–39 years, who accounted for 39 (19.5%). Seventeen participants (8.5%) were aged 30–34 years, 11 (5.5%) were aged 25–29 years, and 6 (3.0%) were aged 18–24 years. Thus, the study population was predominantly composed of participants aged 40 years and above.

4.2 Contraceptive Effectiveness and Complications

Both contraceptive methods demonstrated high effectiveness. Pregnancy occurred in only one participant (1.0%) in the Copper-IUD group, whereas no pregnancies were recorded among LNG-IUD users. This difference was not statistically significant (P = 1.000).

Device expulsion occurred in six Copper-IUD users (6.0%) compared with three LNG-IUD users (3.0%). The difference was not statistically significant (P = 0.498).

Pelvic infection was uncommon in both groups, occurring in three Copper-IUD users (3.0%) and two LNG-IUD users (2.0%), with no statistically significant difference (P = 1.000).

4.3 Menstrual Outcomes

Marked differences were observed in menstrual outcomes. Increased menstrual bleeding was reported by 32 Copper-IUD users (32.0%) compared with only eight LNG-IUD users (8.0%). This difference was highly statistically significant (P < 0.001). Dysmenorrhea was also significantly more common among Copper-IUD users, occurring in 28 participants (28.0%) compared with 10 LNG-IUD users (10.0%; P = 0.001).

4.4 Patient Satisfaction

Patient satisfaction was high in both groups. Eighty-two Copper-IUD users (82.0%) reported satisfaction compared with 91 LNG-IUD users (91.0%). Although satisfaction was numerically higher among LNG-IUD users, the difference did not reach statistical significance (P = 0.063).

Table 2. Comparison of Clinical Outcomes Between Copper-IUD and LNG-IUD Users

Clinical outcome	Copper-IUD (n = 100), n (%)	LNG-IUD (n = 100), n (%)	Statistical test	*P* value	Significance
Pregnancy	1 (1.0)	0 (0.0)	Fisher's exact	1.000	NS
Device expulsion	6 (6.0)	3 (3.0)	Fisher's exact	0.498	NS
Pelvic infection	3 (3.0)	2 (2.0)	Fisher's exact	1.000	NS
Increased menstrual bleeding	32 (32.0)	8 (8.0)	Pearson χ^2	**<0.001**	**Significant**
Dysmenorrhea	28 (28.0)	10 (10.0)	Pearson χ^2	**0.001**	**Significant**
Patient satisfaction	82 (82.0)	91 (91.0)	Pearson χ^2	0.063	NS

Note. Values are expressed as n (%). NS = not statistically significant. P < 0.05 was considered statistically significant.

5. DISCUSSION

The present comparative observational study evaluated 200 IUD users, comprising 100 Copper-IUD users and 100 LNG-IUD users. Both methods demonstrated high contraceptive effectiveness, while important differences emerged in menstrual outcomes. The study found significantly higher frequencies of increased menstrual bleeding and dysmenorrhea among Copper-IUD users, whereas pregnancy, device expulsion, pelvic infection, and patient satisfaction did not differ significantly between the groups. These are the principal clinical findings recorded in the study dataset.

Pregnancy was uncommon in both study groups. Only one pregnancy (1.0%) occurred among Copper-IUD users, while no pregnancy was observed among LNG-IUD users. The difference was not statistically significant ($P = 1.000$). The low pregnancy rates observed in both groups support the established high contraceptive effectiveness of intrauterine contraception [1,2,4-8].

These findings are also consistent with evidence demonstrating that long-acting reversible contraceptives have substantially lower failure rates than shorter-acting contraceptive methods that depend more heavily on correct and consistent user adherence [31]. Previous randomized and long-term studies comparing copper and levonorgestrel intrauterine systems have similarly demonstrated sustained contraceptive efficacy over extended periods of use [23–26,36,37,40].

The absence of a statistically significant difference in pregnancy rates in the present study should nevertheless be interpreted cautiously. Pregnancy was a very rare outcome, and the study included only 100 participants in each group. Consequently, the study was not sufficiently large to establish equivalence between the two methods for rare contraceptive failures.

Device expulsion occurred in 6.0% of Copper-IUD users and 3.0% of LNG-IUD users. Although the observed frequency was numerically twice as high in the Copper-IUD group, the difference was not statistically significant ($P = 0.498$).

IUD expulsion is a recognized complication, and reported rates vary according to the characteristics of the population, device, timing of insertion, age, parity, and duration of follow-up [13,27,29]. Madden et al. [29], for example, identified age and parity as factors associated with expulsion risk. Timing of insertion is also relevant, particularly in postpartum and post-abortion settings [34,35].

The present findings therefore suggest a numerical difference in expulsion between the two study groups but do not provide sufficient statistical evidence to conclude that the Copper-IUD carries a higher expulsion risk in this population.

Pelvic infection occurred in three Copper-IUD users (3.0%) and two LNG-IUD users (2.0%), and the difference was not statistically significant ($P = 1.000$). Historically, concerns regarding pelvic inflammatory disease contributed substantially to misconceptions surrounding IUD safety. Contemporary evidence, however, indicates that the overall risk is low and that infection is more closely associated with exposure to sexually transmitted pathogens around the time of insertion than with continued presence of the IUD [14,21,22].

Systematic evidence has also indicated that appropriately selected patients can safely use intrauterine contraception when recommended infection-prevention and screening practices are followed [1,2,14,15]. The low frequency of infection observed in both groups in the present study is therefore broadly consistent with the established safety profile of modern IUDs.

The most pronounced difference between the two groups involved menstrual bleeding. Increased menstrual bleeding was reported by 32 Copper-IUD users (32.0%) compared with only eight LNG-IUD users (8.0%). The difference was highly statistically significant ($P < 0.001$). Thus, increased menstrual bleeding was four times as frequent among Copper-IUD users in the present sample. This finding is consistent with previous evidence indicating that copper-containing devices can increase menstrual blood loss, particularly during the initial period following insertion [9,23,24].

The substantially lower rate of increased bleeding among LNG-IUD users is also biologically and clinically plausible. Levonorgestrel released within the uterine cavity produces endometrial suppression and reduces endometrial proliferation. Consequently, menstrual blood loss generally decreases with continued LNG-IUD use [8,11,36,38,39]. The clinical relevance of this difference extends beyond patient comfort. Persistent or unacceptable bleeding can affect contraceptive continuation and satisfaction. Therefore, individuals with pre-existing heavy menstrual bleeding or concerns about increased menstrual flow should receive specific counseling about the different bleeding profiles of Copper-IUDs and LNG-IUDs [8,9,38,39].

A similar pattern was observed for dysmenorrhea. Dysmenorrhea occurred in 28.0% of Copper-IUD users compared with 10.0% of LNG-IUD users, representing a statistically significant difference ($P = 0.001$). Copper-IUD-associated menstrual cramping has been described in previous studies and reviews [9,23,24]. In contrast, LNG-IUDs may improve dysmenorrhea through endometrial suppression and reduction of menstrual blood loss [8,11,38,39]. The present findings therefore reinforce the importance of

considering baseline menstrual symptoms during contraceptive counseling. An individual already experiencing heavy or painful menstruation may have different priorities from someone specifically seeking hormone-free contraception.

Patient satisfaction was high in both groups. Satisfaction was reported by 82.0% of Copper-IUD users and 91.0% of LNG-IUD users. Although this represented a nine-percentage-point numerical advantage for LNG-IUDs, the difference did not reach conventional statistical significance ($P = 0.063$). High satisfaction with long-acting reversible contraception has been reported in previous research [31–33]. Peipert et al. [32] demonstrated high continuation and satisfaction with reversible contraceptive methods, while longer-term studies have also reported favorable continuation patterns among LARC users [33].

The higher numerical satisfaction observed among LNG-IUD users in the present study may partly relate to their lower frequency of increased bleeding and dysmenorrhea. However, because satisfaction was not analyzed in relation to individual adverse outcomes, such an association cannot be established from the current data. Patient satisfaction is multidimensional and may be influenced by contraceptive effectiveness, menstrual effects, insertion experience, expectations, previous contraceptive use, access to healthcare, reproductive goals, and quality of counseling [8,12,13,31-33]. Future studies using validated satisfaction instruments could provide a more detailed understanding of these relationships.

The age distribution of the study population is another important consideration. Of the 200 participants, 127 (63.5%) were aged ≥40 years, while 39 (19.5%) were aged 35–39 years. Only 17.0% of participants were younger than 35 years. The predominance of older participants should be considered when interpreting the findings. Age may influence reproductive intentions, contraceptive priorities, continuation patterns, menstrual characteristics, and perception of adverse effects. Previous research has also suggested that age can influence certain IUD outcomes, including expulsion [29,30].

Because age distribution was available only for the overall population rather than separately for the Copper-IUD and LNG-IUD groups, the present analysis cannot determine whether the two groups were comparable with respect to age. Future studies should report baseline demographic characteristics separately for each treatment group and adjust for potentially important confounding variables where appropriate.

Taken together, the low pregnancy and infection rates observed in the study support the overall safety and effectiveness of intrauterine contraception. Evidence from clinical guidelines, systematic reviews, randomized trials, and observational studies similarly supports the use of IUDs across a broad range of medically eligible individuals [1-4,12-15]. Rare complications should nevertheless be discussed during counseling. Uterine perforation, for example, remains uncommon but requires appropriate insertion technique and recognition of relevant clinical risk factors [27,28]. Expulsion should also be discussed, particularly when insertion occurs in circumstances associated with higher risk [29,34,35].

The significant differences in menstrual outcomes observed in the present study are particularly relevant to individualized contraceptive selection. Copper-IUDs remain an important option for individuals who prefer highly effective contraception without hormonal exposure [5,6,9]. LNG-IUDs, meanwhile, provide similarly effective contraception with the additional potential benefit of reducing menstrual blood loss and dysmenorrhea [8,11,36-40].

The findings indicate that the choice between a Copper-IUD and an LNG-IUD should not be based solely on pregnancy prevention. Both methods were highly effective in the present study, and neither demonstrated a significant difference in pregnancy, expulsion, or pelvic infection. The major distinction was the menstrual experience. Copper-IUD users had significantly higher frequencies of increased menstrual bleeding and dysmenorrhea, whereas LNG-IUD users experienced more favorable menstrual outcomes. Satisfaction was also numerically higher among LNG-IUD users, although this difference was not statistically significant. These findings support a patient-centered approach to IUD selection. Counseling should incorporate contraceptive effectiveness, expected bleeding patterns, menstrual pain, preference regarding hormonal exposure, reproductive goals, potential adverse effects, and individual medical eligibility [1-3,12,13]. Shared decision-making may improve realistic expectations, satisfaction, and long-term continuation.

6. Clinical Implications

The findings highlight the importance of comprehensive pre-insertion counseling. Patients considering a Copper-IUD should be informed about the possibility of heavier bleeding and increased menstrual cramping. Conversely, those considering an LNG-IUD should understand that irregular bleeding may occur initially but that menstrual blood loss commonly decreases with continued use. Patients should also receive balanced information regarding uncommon complications. Although uterine perforation and pelvic infection are recognized concerns, serious IUD complications are uncommon when insertion is performed appropriately. The final contraceptive choice should reflect the patient's reproductive goals, menstrual characteristics, medical eligibility, preference for hormonal or non-hormonal contraception, and tolerance of possible adverse effects.

7. Strengths and Limitations

An important strength of the study is the direct comparison of equal-sized Copper-IUD and LNG-IUD groups, allowing clinically relevant differences in outcomes to be examined.

Several limitations should also be acknowledged. The sample size was relatively modest, particularly for rare events such as pregnancy and pelvic infection. Consequently, the study may have had insufficient statistical power to detect small differences in uncommon complications.

The age distribution was strongly weighted toward participants aged ≥40 years, potentially limiting generalizability to younger IUD users. In addition, patient satisfaction was assessed as a categorical outcome, and the factors contributing to satisfaction were not evaluated separately.

Information on potential confounders such as parity, previous contraceptive use, baseline menstrual characteristics, socioeconomic status, comorbidities, and duration of IUD use was not included in the supplied dataset. These factors should be considered in future studies.

8. RECOMMENDATIONS

Future research should include larger and more age-diverse populations and should evaluate participants prospectively over a defined follow-up period. Baseline menstrual characteristics should be documented before insertion so that changes after IUD placement can be measured more accurately.

Further studies should also evaluate continuation and discontinuation rates, reasons for removal, quality of life, satisfaction using validated scales, hemoglobin levels in patients experiencing heavy menstrual bleeding, and the influence of parity and previous contraceptive experience.

9. CONCLUSION

Both Copper-IUD and LNG-IUD demonstrated high contraceptive effectiveness and relatively low rates of device expulsion and pelvic infection in the present study. The principal differences involved menstrual outcomes. Copper-IUD users experienced significantly higher rates of increased menstrual bleeding and dysmenorrhea than LNG-IUD users. Patient satisfaction was numerically higher among LNG-IUD users, although the difference was not statistically significant. These findings reinforce the importance of individualized contraceptive counseling. Contraceptive efficacy should be considered together with menstrual characteristics, reproductive intentions, preference for hormonal or non-hormonal contraception, medical eligibility, and anticipated adverse effects. Appropriate counseling before insertion may help establish realistic expectations, facilitate informed contraceptive choice, and potentially improve satisfaction and continuation.

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