Immunopathologia Persa
http immunopathol.com
DOI:10.34172/ipp.2025.43953

Association between levonorgestrel-releasing intrauterine system and breast carcinoma; a systematic review and meta-analysis

Reihaneh Bayat[1], Hamta Taheri Sarvetamin[2], Zohreh Akbari[3], Fatemeh Hasanzadeh Sablouei[4], Saba Bazzazi[5], Peyman Khajehnabi[6], Sadaf Rassouli[7], Parsa Barzegar[8], Farzaneh Ramezani[9*]

[1]Department of General Surgery, Taleghani Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[2]Department of Radiology, Faculty of Medicine, Jiroft University of Medical Sciences, Jiroft, Iran
[3]Department of Critical Care Nursing, School of Nursing and Midwifery, Neyshabur University of Medical Sciences, Neyshabur, Iran
[4]Department of Operating Room, School of Nursing and Midwifery, Rafsanjan University of Medical Sciences, Rafsanjan, Iran
[5]Preventative Gynecology Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[6]Department of Pharmacology, Cyprus International University, Lefkosa, North Cyprus
[7]Department of Gynecology and Obstetrics, Imam Khomeini Hospital, School of Medicine, Sari University of Medical Sciences, Sari, Iran
[8]Faculty of Medicine, University of Belgrade, Belgrade, Serbia
[9]Department of Pathology, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

***Correspondence to**
Farzaneh Ramezani, Email: Farzanermm@gmail.com

Received 4 Jun. 2025
Revised: 3 Aug. 2025
Accepted 24 Aug. 2025
ePublished 4 Oct. 2025

Keywords: Levonorgestrel-releasing intrauterine device, LNG-IUD, Levonorgestrel-releasing intrauterine system, LNG-IUS, Breast neoplasms, Breast tumor, Breast cancer, Breast carcinoma

Abstract

Introduction: Breast carcinoma is the most common carcinoma in women, and using levonorgestrel-releasing intrauterine device (LNG-IUD) may increase the risk of breast neoplasm. Accordingly, the present study aimed to investigate the relationship between LNG-IUS use and the risk of breast neoplasm in women.

Materials and Methods: Databases PubMed, Cochrane, Scopus, Embase, Web of Science, and Google Scholar Search Engine were used to search for articles published until June 6, 2025. Data was analyzed using STATA 14.

Results: A total of 12 articles with 3774290 women were reviewed, and findings revealed that LNG-IUS use increased the risk of breast carcinoma based on OR (1.27, 95% CI: 1.08, 1.51), SIR (1.20, 95% CI: 1.16, 1.24), and IRR (1.20, 95% CI: 1.08, 1.34). Furthermore, using LNG-IUS in Sweden (OR: 1.14, 95% CI: 1.10, 1.18), Finland (OR: 1.28, 95% CI: 1.17, 1.40), Denmark (OR: 1.21, 95% CI: 1.11, 1.32), Australia (OR: 1.26, 95% CI: 1.21, 1.31), and Korea (OR: 1.38, 95% CI: 1.20, 1.59) increased the risk of breast neoplasm. However, the relationship between LNG-IUS use and breast neoplasm in China (OR: 0.91, 95% CI: 0.74, 1.12), Germany (OR: 0.99, 95% CI: 0.88, 1.12), and Norway (OR: 1.03, 95% CI: 0.91, 1.17) was statistically insignificant. On the other hand, using LNG-IUSs for less than 10 years (OR: 1.21, 95% CI: 1.09, 1.34) and for 10 years or more (OR: 1.21, 95% CI: 1.12, 1.30) increased the risk of breast carcinoma.

Conclusion: Using LNG-IUS increases the risk of breast carcinoma. However, the longer durations of LNG-IUS use did not affect the risk of breast carcinoma incidence. Among the LNG-IUS users, Korean (38%) and Swedish (14%) women showed the highest and lowest risks of breast carcinoma, respectively.

Registration: This study has been compiled based on the PRISMA checklist, and its protocol was registered on the PROSPERO (ID: CRD420251090346) and Research Registry (UIN reviewregistry2020) websites.

Citation: Bayat R, Taheri Sarvetamin H, Akbari Z, Hasanzadeh Sablouei F, Bazzazi S, Khajehnabi P, Rassouli S, Barzegar P, Ramezani F. Association between levonorgestrel-releasing intrauterine system and breast carcinoma; a systematic review and meta-analysis. Immunopathol Persa. 2025;x(x):e43953. DOI:10.34172/ipp.2025.43953.

Introduction

The World Health Organization (WHO) has recommended levonorgestrel-releasing intrauterine device (LNG-IUD), which is approved by more than 115 countries (1). LNG-IUD is used for endometriosis and menorrhagia treatment (2,3), and it is the second most frequent contraceptive following oral birth control pills, and the most common long-acting reversible contraception method (4), which is used in postmenopausal hormone replacement therapy (5). The frequent side effects of LNG-IUS placement include failure in placement, pain, infection, and expulsion (6).

Breast carcinoma is the most common carcinoma in women, which has overtaken lung carcinoma in 2020 as the previous most frequent carcinoma (7). Factors effective in developing breast cancer include body mass index (BMI), family history of cancer, age, and diet (8,9). The requirement of progesterone in the natural growth of mammary glands is well-established (10); however, the mechanism through which progestins, such as levonorgestrel, affect the risk of breast carcinoma is unknown. Yet, it probably includes the activation of progesterone

Key point

The application of levonorgestrel-releasing intrauterine device (LNG-IUD) increased the risk of breast carcinoma. However, longer durations of LNG-IUS use did not affect the risk of breast carcinoma. Besides, among the LNG-IUS users, Korean (38%) and Swedish (14%) women had the highest and lowest rates of breast cancer occurrence, respectively. It is recommended that future research focus on original studies on this issue.

receptors in breast tissues that leads to the proliferation of epithelial cells (11). Due to the systemic absorption of levonorgestrel (powerful synthetic progesterone), LNG-IUS may cause breast neoplasm (12). Various studies have presented inconsistent results regarding this issue. Some articles reported that LNG-IUSs increased the risk of breast carcinoma (13,14), whereas others did not find a statistically significant association between LNG-IUS and breast neoplasm (15,16). Hence, this study was conducted aiming to investigate the association between LNG-IUS use and breast cancer in women.

Materials and Methods

Study design

This study used Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (17), and its protocol was registered at the websites PROSPERO (International Prospective Register of Systematic Reviews) and research registry.

Search strategy

The databases utilized in this research include PubMed, Scopus, Embase, Cochrane, Web of Science, and Google Scholar, with no restrictions on time or language up to June 6, 2025. The search employed Medical Subject Headings (MeSH) terms and Boolean operators (AND, OR). Additionally, a manual search was conducted for primary sources. The search strategy in the Web of Science database was as follows: Levonorgestrel-releasing intrauterine device OR LNG-IUD OR Levonorgestrel-releasing intrauterine system OR LNG-IUS (All Fields) AND Breast Neoplasms OR Breast Tumor OR Breast Cancer OR Breast Carcinoma (All Fields)

PICO components

- Population: Studies that aimed to investigate the association between LNG-IUS and breast carcinoma.
- Intervention: Application of LNG-IUS.
- Comparison: Women who did not use LNG-IUS.
- Outcomes: Association between LNG-IUS use and breast neoplasm.
-

Inclusion criteria

Observational studies that aimed to examine the association between LNG-IUS use and breast neoplasm.

Exclusion criteria

Articles that investigated the relationship between oral contraceptive pills and breast neoplasm; studies on the effect of LNG-IUS on neoplasms other than breast carcinoma; case reports; systematic reviews; studies that investigated the impact of LNG-IUS and estrogen on breast carcinoma; duplicate studies; studies without accessible full-texts; studies without sufficient data, and low-quality studies.

Quality assessment

This article used the Newcastle-Ottawa scale, which has 9 questions and its final score is a number between 0 and 10. In this scale, questions are rated as stars, and a score above 5 indicates a quality article (18).

Data extraction

Researchers extracted information including the design, study duration, age, number of samples, year, follow-up, indicator, country, author's name, and the relationship between LNG-IUS and breast carcinoma. Then, the two researchers reached an agreement to resolve the discrepancies.

Statistical analysis

Logarithms of indices, including relative risk (RR), incidence rate ratio (IRR), odds ratio (OR), hazard ratio (HR), and standardized incidence ratio (SIR) were used to analyze the data, and the articles were combined. The I^2 index was used to evaluate the heterogeneity. A random effects model was used. Data analyzed with STATA 14. Tests with P values < 0.05 were considered significant.

Results

Overall, a total of 316 articles were found in the search step. Then, 152 duplicate studies were identified and removed. The abstracts were examined, and five articles without full texts were removed. Out of the 159 remaining articles, 78 lacked the required data and were excluded, and out of the 81 articles that entered the next stage, 69 were removed due to other exclusion criteria, and 12 studies remained (Figure 1). In this study a total of 3,774,290 participants were investigated (Table 1).

Subgroup analysis demonstrated that LNG-IUS use in Sweden (OR: 1.14, 95% CI: 1.10, 1.18), Finland (OR: 1.28, 95% CI: 1.17, 1.40), Denmark (OR: 1.21, 95% CI: 1.11, 1.32), Australia (OR: 1.26, 95% CI: 1.21, 1.31), and Korea (OR: 1.38, 95% CI: 1.20, 1.59) increased the risk of breast carcinoma. However, the association between LNG-IUS use and breast carcinoma in China (OR: 0.91, 95% CI: 0.74, 1.12), Germany (OR: 0.99, 95% CI: 0.88, 1.12), and Norway (OR: 1.03, 95% CI: 0.91, 1.17) was statistically insignificant (Figure 2).

Various indicators led to different results, as the relationship between LNG-IUS and breast carcinoma based on HR (1.14, 95% CI: 0.96, 1.35) and RR (1.12, 95%

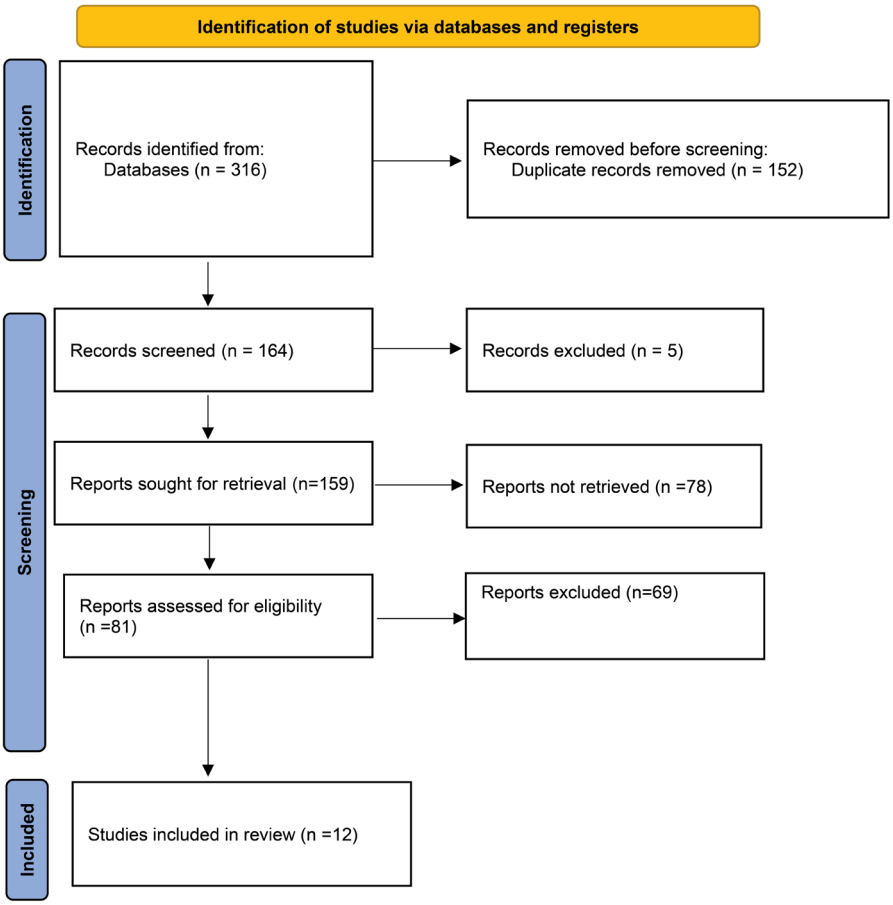

Figure 1. The PRISMA flow chart of study selection.

CI: 0.96, 1.31) was statistically insignificant; however, based on OR (1.27, 95% CI: 1.08, 1.51), SIR (1.20, 95% CI: 1.16, 1.24), and IRR (1.20, 95% CI: 1.08, 1.34), LNG-IUS use increased the risk of breast carcinoma (Figure 3).

Application of LNG-IUS in cohorts (OR: 1.17, 95% CI: 1.12, 1.22) and case-controls (OR: 1.27, 95% CI: 1.08, 1.51) increased the risk of breast neoplasm (Figure 4).

Furthermore, using LNG-IUS for less than 10 years (OR: 1.21, 95% CI: 1.09, 1.34) and for 10 years or more (OR: 1.21, 95% CI: 1.12, 1.30) increased the risk of breast carcinoma (Figure 5).

Meta-regression revealed that the association between 'the LNG-IUS use and breast neoplasm' and year (P = 0.494) and number of samples (P = 0.858) was statistically

Table 1. Summarized data of the researches

Author, year	Index	Country	Design	Duration of study	Sample size	Mean age (year)	Follow-up (year)
Yuk JS, 2025 (13)	HR	Korea	Cohort	2013-2022	61010	NR	7.1
Tuesley KM, 2025 (14)	OR	Australia	Case-control	2004-2013	285752	NR	9
Yi H, 2024 (19)	HR	Sweden	Cohort	2005-2018	2058876	NR	10
Hultstrand JN, 2022 (20)	IRR	Sweden	Cohort	2005-2017	1652364	25.7	8.7
Jareid M, 2018 (15)	RR	Norway	Cohort	1991-2007	104318	NR	12.5
Morch LS, 2017 (21)	RR	Denmark	Cohort	1995-2012	1800000	40.1	10.9
Soini T, 2016 (11)	SIR	Finland	Cohort	1994 - 2007	93843	30-55	NR
Heikkinen S, 2016(22)	OR	Finland	Case-control	2000-2007	25560	NR	11
Soini T, 2014 (23)	SIR	Finland	Cohort	1994-2007	93843	30-54	15
Dinger J, 2011 (16)	OR	Germany	Case-control	2000-2007	25565	NR	NR
Lyytinen HK, 2010 (24)	OR	Finland	Case-control	1995-2007	39824	NR	12
Dorjgochoo T, 2009 (25)	HR	China	Cohort	1997-2000	29922	46.3	7.5

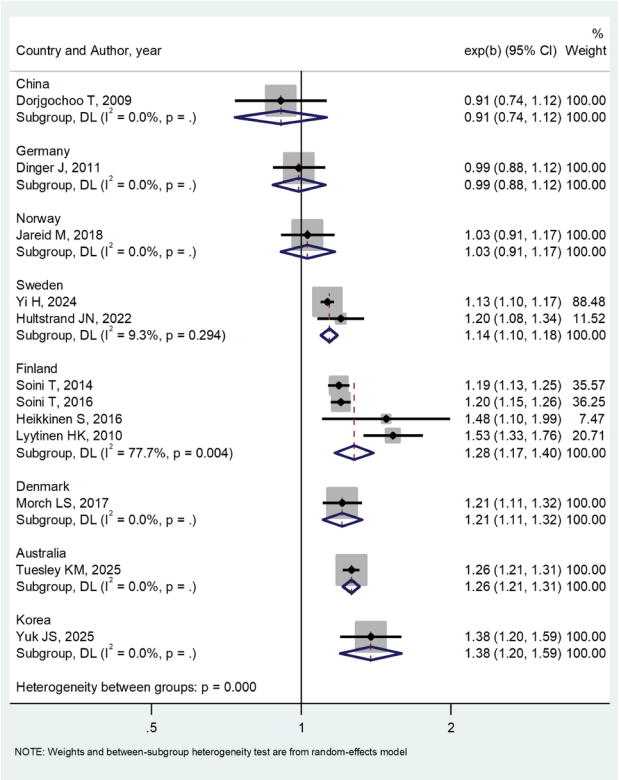

Figure 2. Forest plot showing the association between LNG-IUS and breast carcinoma by country.

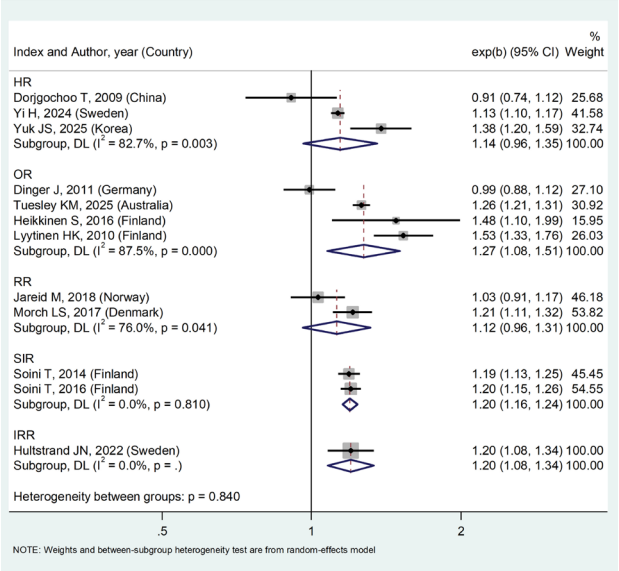

Figure 3. Forest plot showing the association between LNG-IUS and breast carcinoma by index..

insignificant (Figures 6 and 7).

As shown in Figure 8, the publication bias plot was statistically insignificant ($P = 0.770$).

The sensitivity analysis plot demonstrated that studies by Lyytinen et al (24) and Dinger et al (16) were the most effective on the general results of the current meta-analysis (Figure 9).

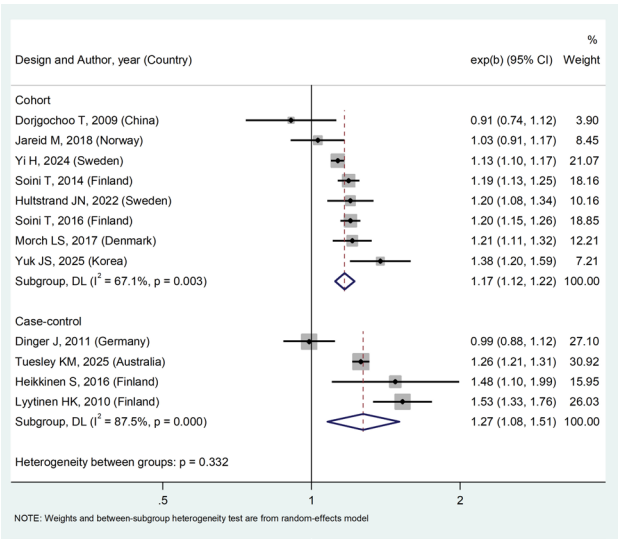

Figure 4. Forest plot showing the association between LNG-IUS and breast carcinoma by design.

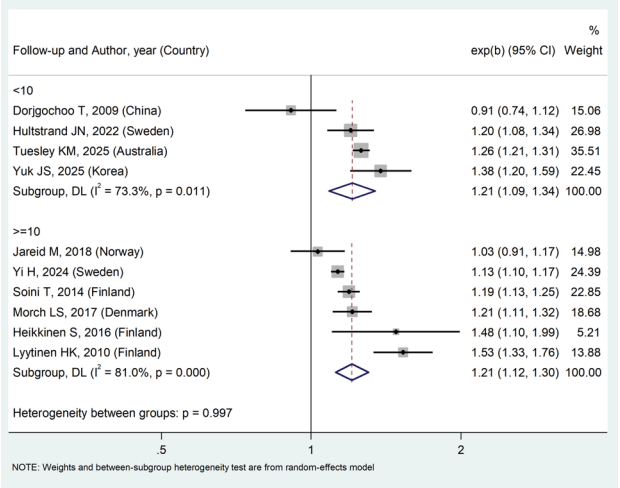

Figure 5. Forest plot showing the association between LNG-IUS and breast carcinoma by follow-up.

Discussion

Results indicated that LNG-IUS use based on OR (27%), SIR (20%), and IRR (20%) increased the risk of breast carcinoma. Furthermore, LNG-IUS applications in Sweden (14%), Finland (28%), Denmark (21%), Australia (26%), and Korea (38%) increased the risk of breast carcinoma. On the other hand, using LNG-IUS for less than 10 years (21%) and for 10 years or more (21%) increased the risk of breast neoplasm.

In a meta-analysis by Conz et al, findings indicated a higher breast carcinoma risk (OR: 1.16, 95% CI: 1.06-1.28) in those who used LNG-IUS (26). Zurcher et al reported a systematic review of 10 studies, and their results showed that user LNG-IUS faced higher risks of breast neoplasm (27). These studies confirmed our results and demonstrated that LNG-IUS use is a risk factor for breast carcinoma incidence in women, with a difference that the

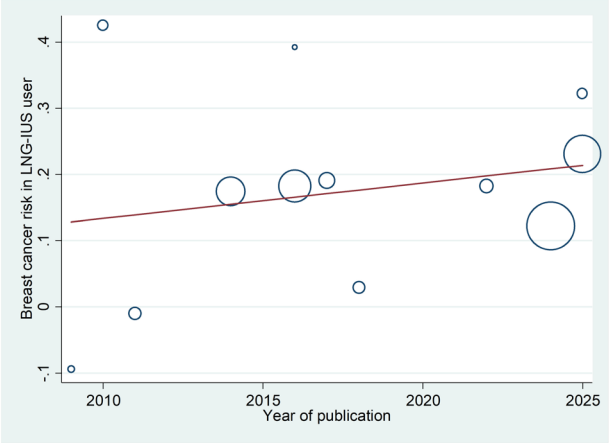

Figure 6. Meta-regression of the relationship between LNG-IUS and breast neoplasm by year.

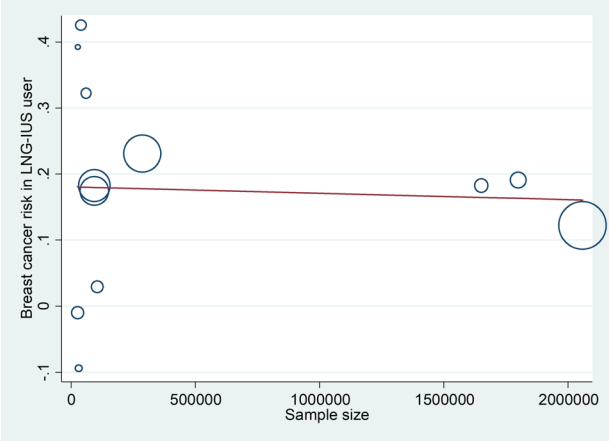

Figure 7. Meta-regression of the relationship between LNG-IUS and breast neoplasm by number of samples.

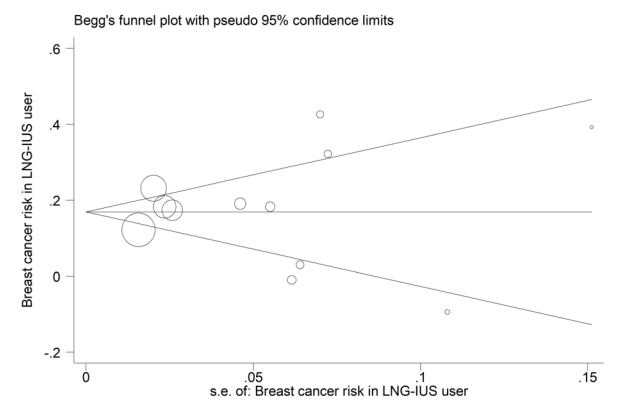

Figure 8. Diagram of publication bias.

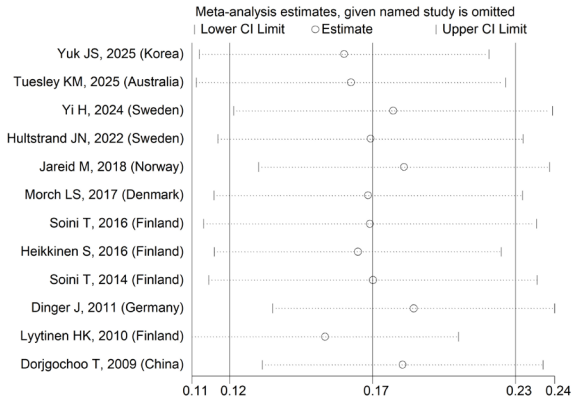

Figure 9. Diagram of sensitivity analysis.

meta-analyses by Conz et al reviewed articles published before 2019, whereas the current meta-analysis included those published before 2019 and those from 2019 to 2025.

In another meta-analysis by Heting et al, no significant relationship was seined between breast carcinoma and LNG-IUS use (case-controls [OR: 1.38, 95% CI: 0.98, 1.94], and cohorts [RR: 0.80, 95% CI: 0.57, 1.11]) (12). Another meta-analyses by Silva et al, there was no statistically significant association between breast cancer and LNG-IUS use either in cohort (RR: 0.93, 95% CI: 0.84,1.03) or case-control (RR: 1.07, 95% CI: 0.91, 1.26) studies (28). The studies mentioned above were not consistent with the present article, as in the current meta-analyses, both the cohort and case-control studies reported that LNG-IUS use increased the risk of breast neoplasm.

In the study by D'Alessandro et al aiming to examine the impact of LNG-IUS on reducing ovarian neoplasm, results revealed that in comparison with not using LNG-IUS, LNG-IUS use did not reduce ovarian neoplasm (OR: 0.66, 95% CI: 0.41, 1.08) (29), which was contrary to our findings, and indicated that using LNG-IUS was not a risk factor for ovarian cancer and even prevented ovarian neoplasm by up to 34%.

In an umbrella review by Lessa et al aiming to investigate the association between IUD use and occurrence of malignancies, results indicated a reduction in the risk of cervical (OR: 0.63, 95% CI: 0.48, 0.82), ovarian (OR: 0.71, 95% CI: 0.59, 0.86), and endometrial (OR: 0.41, 95% CI: 0.31, 0.54) cancer in women who permanently used IUDs. However, findings indicated no significant relationship between using IUDs and breast neoplasm (OR: 1.00, 95% CI: 0.70, 1.41) (30), which was inconsistent with the present study.

In a previous meta-analysis by Fitzpatrick et al findings showed that if the last prescription for hormonal contraception was for combined oral contraceptive pills, oral progesterone, injectable progesterone, or progesterone-releasing IUD, the risk of breast neoplasm significantly increased ((OR: 1.23, 95% CI: 1.14, 1.32), (OR: 1.26, 95% CI: 1.16, 1.37), (OR: 1.25, 95% CI: 1.07, 1.45), and (OR: 1.32, 95% CI: 1.17, 1.49), respectively) (31). Results of a meta-analysis demonstrated that any type of menopausal hormone therapy, except for vaginal estrogens, was associated with an increased risk of breast neoplasm (32). These studies were consistent with the current article, indicating that hormone therapy increases the risk of breast carcinoma.

Conclusion

The application of LNG-IUS increased the risk of breast neoplasm. However, longer durations of LNG-IUS use did not affect the risk of breast carcinoma. Besides, among the LNG-IUS users, Korean (38%) and Swedish (14%) women had the highest and lowest rates of breast cancer occurrence, respectively. It is recommended to conduct more original studies on this issue in the future.

Limitations of the study

The studies were not homogeneous and were reported based on different indicators. Some studies did not report the mean age of the women.

Acknowledgments

The authors would like to thank Yassamin Rabiei and Diana Sarokhani for their guidance and editing of the manuscript registration on the PROSPERO and research registry websites.

Authors' contribution

Conceptualization: Reihaneh Bayat and Fatemeh Hasanzadeh Sablouei
Data curation: Farzaneh Ramezani and Parsa Barzegar
Formal analysis: Hamta Taheri Sarvetamin and Peyman Khajehnabi
Methodology: Hamta Taheri Sarvetamin and Saba Bazzazi.
Validation: Saba Bazzazi and Peyman Khajehnabi.
Investigation: Zohreh Akbari and Sadaf Rassouli.
Visualization: Reihaneh Bayat and Fatemeh Hasanzadeh Sablouei.
Supervision: Reihaneh Bayat.
Project Management: Farzaneh Ramezani.
Writing–original draft: All authors.
Writing–review and editing: All authors.

Conflicts of interest

There are no competing interests.

Ethical issues

This study has been compiled based on the PRISMA checklist, and its protocol was registered on the PROSPERO website (ID: CRD420251090346) and the Research Registry website with (Unique Identifying Number [UIN]: reviewregistry2020). Besides, ethical issues (including plagiarism, data fabrication, and double publication) have been completely observed by the author.

Funding/Support

No funding.

References

1. Grandi G, Farulla A, Sileo F, Facchinetti F. Levonorgestrel-releasing intra-uterine systems as female contraceptives. Expert Opin Pharmacother. 2018;19:677-86. doi:10.1080/14656566.2018.1462337
2. Luo L, Luo B, Zheng Y, Zhang H, Li J, Sidell N. Levonorgestrel-releasing intrauterine system for atypical endometrial hyperplasia. Cochrane Database Syst Rev. 2013;6:CD009458. doi:10.1002/14651858.CD009458.pub2
3. Bahamondes L, Bahamondes MV, Shulman L. Non-contraceptive benefits of hormonal and intrauterine reversible contraceptive methods. Hum Reprod Update. 2015;21:640-51. doi:10.1093/humupd/dmv023
4. Lindh I, Skjeldestad F, Gemzell-Danielsson K, Heikinheimo O, Hognert H, Milsom I, et al. Contraceptive use in the Nordic countries. Acta Obstet Gynecol Scand. 2017;96:19-28. doi:10.1111/aogs.13055
5. Rodriguez M, Lethaby A, Jordan V. Progestogen-releasing intrauterine systems for heavy menstrual bleeding. Cochrane Database Syst Rev. 2020;6:CD002126. doi:10.1002/14651858.CD002126.pub4
6. Ferguson C, Costescu D, Jamieson M, Jong L. Transmural migration and perforation of a levonorgestrel intrauterine system: a case report and review of the literature. Contraception. 2016;93:81-6. doi:10.1016/j.contraception.2015.08.019
7. Siegel R, Miller K, Fuchs H, Jemal A. Cancer statistics, 2022. CA Cancer J Clin. 2022;72:7-33. doi:10.3322/caac.21708
8. Engmann N, Golmakani M, Miglioretti D, Sprague B, Kerlikowske K; Breast Cancer Surveillance Consortium. Population-attributable risk proportion of clinical risk factors for breast cancer. JAMA Oncol. 2017;3:1228-36. doi:10.1001/jamaoncol.2016.6326
9. Win A, Reece J, Ryan S. Family history and risk of endometrial cancer: a systematic review and meta-analysis. Obstet Gynecol. 2015;125:89-98. doi:10.1097/AOG.0000000000000563
10. Graham J, Clarke C. Physiological action of progesterone in target tissues. Endocr Rev. 1997;18:502-19. doi:10.1210/edrv.18.4.0308
11. Soini T, Hurskainen R, Grénman S, Mäenpää J, Paavonen J, Joensuu H, et al. Levonorgestrel-releasing intrauterine system and the risk of breast cancer: a nationwide cohort study. Acta Oncol. 2016;55:188-92. doi:10.3109/0284186X.2015.1062538
12. Heting M, Wenping L, Yanan W, Dongni Z, Xiaoqing W, Zhli Z. Levonorgestrel intrauterine system and breast cancer risk: an updated systematic review and meta-analysis of observational studies. Heliyon. 2023;9:e14733. doi:10.1016/j.heliyon.2023.e14733
13. Yuk J, Kim M, Yoon S, Han G, Noh J. Association between levonorgestrel-releasing intrauterine system exposure duration and breast cancer incidence. Obstet Gynecol. 2025;145:523-31. doi:10.1097/AOG.0000000000005881
14. Tuesley K, Spilsbury K, Pearson S, Donovan P, Obermair A, Coory M, et al. Long-acting, progestin-based contraceptives and risk of breast, gynecological, and other cancers. J Natl Cancer Inst. 2025;117:1046-55. doi:10.1093/jnci/djae282
15. Jareid M, Thalabard J, Aarflot M, Bøvelstad H, Lund E, Braaten T. Levonorgestrel-releasing intrauterine system use is associated with a decreased risk of ovarian and endometrial cancer, without increased risk of breast cancer. Gynecol Oncol. 2018;149:127-32. doi:10.1016/j.ygyno.2018.02.006
16. Dinger J, Bardenheuer K, Do Minh T. Levonorgestrel-releasing and copper intrauterine devices and the risk of breast cancer. Contraception. 2011;83:211-7. doi:10.1016/j.contraception.2010.11.009
17. Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. Syst Rev. 2015;4:1-9. doi:10.1186/2046-4053-4-1
18. Stang A. Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. Eur J Epidemiol. 2010;25:603-5. doi:10.1007/s10654-010-9491-z
19. Yi H, Zhang N, Huang J, Zheng Y, Hong QH, Sundquist J, et al. Association of levonorgestrel-releasing intrauterine device with gynecologic and breast cancers: a national cohort study in Sweden. Am J Obstet Gynecol. 2024;231:450.e1-12. doi:10.1016/j.ajog.2024.05.011
20. Hultstrand J, Gemzell-Danielsson K, Kallner H, Lindman H, Wikman P, Sundström-Poromaa I. Hormonal contraception and risk of breast cancer and breast cancer in situ among Swedish women 15–34 years of age: a nationwide register-

based study. Lancet Reg Health Eur. 2022;21:100470. doi:10.1016/j.lanepe.2022.100470
21. Mørch L, Skovlund C, Hannaford P, Iversen L, Fielding S, Lidegaard Ø. Contemporary hormonal contraception and the risk of breast cancer. N Engl J Med. 2017;377:2228-39. doi:10.1056/NEJMoa1700732
22. Heikkinen S, Koskenvuo M, Malila N, Sarkeala T, Pukkala E, Pitkäniemi J. Use of exogenous hormones and the risk of breast cancer: results from self-reported survey data with validity assessment. Cancer Causes Control. 2016;27:249-58. doi:10.1007/s10552-015-0702-5
23. Soini T, Hurskainen R, Grénman S, Mäenpää J, Paavonen J, Pukkala E. Cancer risk in women using the levonorgestrel-releasing intrauterine system in Finland. Obstet Gynecol. 2014;124:292-9. doi:10.1097/AOG.0000000000000356
24. Lyytinen H, Dyba T, Ylikorkala O, Pukkala E. A case-control study on hormone therapy as a risk factor for breast cancer in Finland: intrauterine system carries a risk as well. Int J Cancer. 2010;126:483-9. doi:10.1002/ijc.24738
25. Dorjgochoo T, Shu X, Li H, Qian H, Yang G, Cai H, et al. Use of oral contraceptives, intrauterine devices and tubal sterilization and cancer risk in a large prospective study, from 1996 to 2006. Int J Cancer. 2009;124:2442-9. doi:10.1002/ijc.24232
26. Conz L, Mota B, Bahamondes L, Teixeira Dória M, Derchain FM, Rieira R, et al. Levonorgestrel-releasing intrauterine system and breast cancer risk: a systematic review and meta-analysis. Acta Obstet Gynecol Scand. 2020;99:970-82. doi:10.1111/aogs.13817
27. Zürcher A, Knabben L, Janka H, Stute P. Influence of the levonorgestrel-releasing intrauterine system on the risk of breast cancer: a systematic review. Arch Gynecol Obstet. 2023;307:1747-61. doi:10.1007/s00404-022-06640-y
28. Silva F, Grande A, Macedo A, Colonetti T, Rocha M, Uggioni M, et al. Meta-analysis of breast cancer risk in levonorgestrel-releasing intrauterine system users. Clin Breast Cancer. 2021;21:497-508. doi:10.1016/j.clbc.2021.03.013
29. D'Alessandro G, Frigerio M, Barra F, Costantini S, Gustavino C, Ferrero S. Systematic review and meta-analysis on the impact of the levonorgestrel-releasing intrauterine system in reducing risk of ovarian cancer. Int J Gynaecol Obstet. 2022;156:418-24. doi:10.1002/ijgo.13737
30. Lessa A, Podlasek A. Intrauterine devices and gynaecological malignancies: an umbrella review of systematic reviews and meta-analyses. Eur J Contracept Reprod Health Care. 2025;30:1-13. doi:10.1080/13625187.2025.2499686
31. Fitzpatrick D, Pirie K, Reeves G, Green J, Beral V. Combined and progestagen-only hormonal contraceptives and breast cancer risk: a UK nested case-control study and meta-analysis. PLoS Med. 2023;20:e1004188. doi:10.1371/journal.pmed.1004188
32. Collaborative Group on Hormonal Factors in Breast Cancer. Type and timing of menopausal hormone therapy and breast cancer risk: individual participant meta-analysis of the worldwide epidemiological evidence. Lancet. 2019;394:1159-68. doi:10.1016/S0140-6736(19)31709-X