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DISCOVERY SCIENTIFIC SOCIETY

Common side effects of hormonal contraception: a narrative review of recent studies

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ABSTRACT

Hormonal contraception is commonly used around the globe. Although there is no doubt about its effectiveness and additional therapeutic benefits, concerns about potential side effects keep influencing contraceptive choice and continuation. The goal of this narrative review is to summarise current evidence regarding both rare but severe risks: cardiovascular events and breast cancer, as well as more common but less significant side effects: headaches, mood changes, weight gain, and metabolic alterations. In this review, we focused on the following contraceptive methods: combined oral contraceptives, progestin-only pills, and hormonal intrauterine devices. Major medical databases were searched, with a focus on studies that were published within the last 10 years. The studies included were cohort studies, randomized clinical trials, cross-sectional studies, meta-analyses, and reviews. The results show a significant distinction in the profiles of side effects between estrogen-containing and progestin-only methods. Combined hormonal contraceptives have been shown to cause an increase in the frequency of cardiovascular events and migraine episodes. The best researched relation between combined hormonal contraceptives and migraine is hormonal-withdrawal migraine. Combined hormonal contraceptives have also shown unfavorable metabolic changes and an increased risk of breast cancer. Progestin-only contraceptives did not show a significant increase in cardiovascular risk, changes in lipid profiles, and have not been shown to worsen migraine symptoms. However, progestin-only methods demonstrate a similar increase in breast cancer risk as combined methods. Results considering the influence that hormonal contraceptives have on mood changes and weight gain do not firmly state that such a relationship exists.

Keywords: combined hormonal contraceptives, progestin-only contraceptives, side effects

1. INTRODUCTION

Women around the globe face the decision of choosing a form of contraception. Roughly 966 million women, between the ages of 15 and 49 years, are currently

using contraception. About 874 million of them rely on modern contraceptive methods, including hormonal contraceptives (United Nations, 2022). While non-hormonal contraception, because of the lack of systemic effects caused by exogenous hormones, appears to be safer, the highest effectiveness in preventing pregnancy belongs to hormonal contraceptives, with only the copper intrauterine device being equally effective (Teal et al., 2021). Hormonal contraceptives appear in a wide range of formulations and delivery systems, the most common being combined estrogen–progestin oral contraceptives, progestin-only pills, levonorgestrel-releasing intrauterine devices (LNG-IUDs), subdermal implants, and vaginal rings. There are multiple mechanisms through which these methods provide contraceptive effectiveness. They include suppression of ovulation, thickening of cervical mucus, and alteration of the endometrium to inhibit implantation (Britton et al., 2020).

Effectiveness is not the only advantage of hormonal contraceptives. Hormonal contraception is commonly used for non-contraceptive therapeutic purposes. It has been shown to have a positive effect on the regulation of menstrual cycles, treatment of dysmenorrhea, reduction of heavy menstrual bleeding, management of acne, and treatment of endometriosis (ESHRE Capri Workshop Group, 2005). Despite these benefits, hormonal contraceptives may be the cause of a broad range of side effects. Limited knowledge of these side effects may affect user experience and lead to discontinuation. Women who use hormonal contraception often report headaches, breast tenderness, mood changes, decreased libido, and weight gain (Karpowicz et al., 2024). They are also concerned about more serious side effects, such as venous thromboembolism, cardiovascular events, and breast cancer. The association between hormonal contraceptives and those side effects seems to be the strongest among women with multiple risk factors (Gompel et al., 2025). Understanding the safety profile of hormonal contraception appears to be crucial for choosing the proper form of contraception, both for clinicians and women themselves. Discontinuation of hormonal contraceptive methods due to perceived side effects appears to be a major issue in reproductive healthcare.

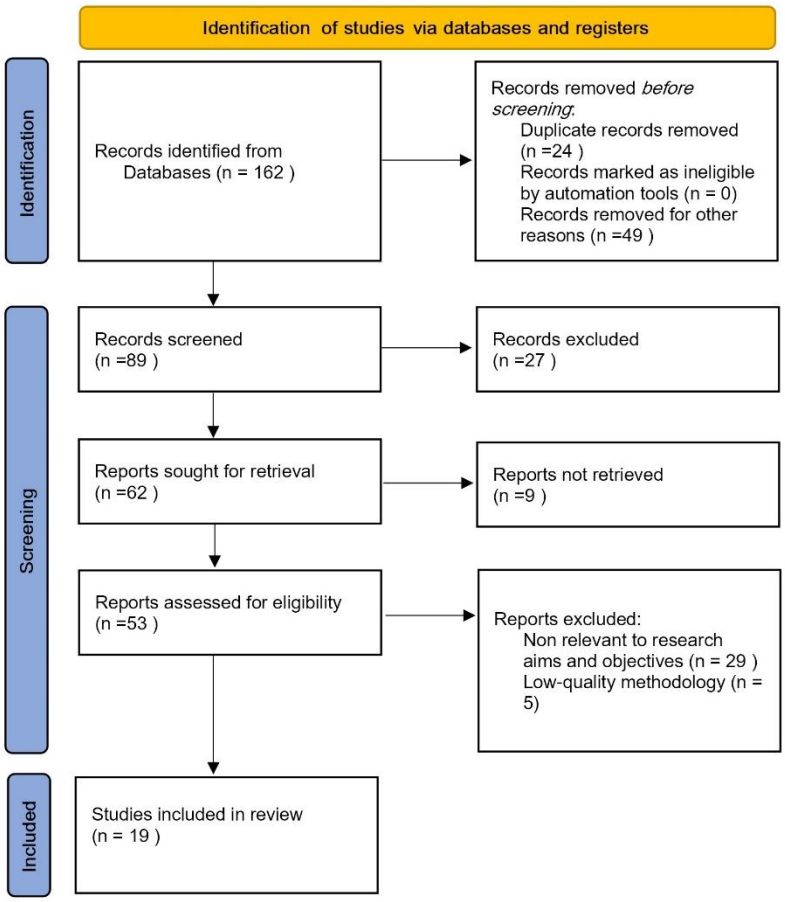

Figure 1. PRISMA flow diagram presenting study selection

In recent years, a significant number of cohort studies, randomized trials, and meta-analyses have been published to provide new insight into the frequency and intensity of these side effects. The goal of this narrative review is to summarise current evidence on the most common adverse effects associated with hormonal contraceptive use, with the highest focus on combined oral contraceptives, progestin-only pills, and hormonal intrauterine devices.

2. REVIEW METHODS

We searched the PubMed database for studies published over the last 10 years (January 2016- January 2026). We used the following search terms: hormonal contraception, combined oral contraceptives, progestin-only pills, hormonal intrauterine device, transdermal patch, vaginal ring, side effects, cardiovascular risk, migraine, headaches, mood disorders, breast cancer, metabolic changes, and weight gain. We included the following study designs: cohort studies, randomized clinical trials, cross-sectional studies, meta-analyses, and high-quality narrative or systematic reviews. We excluded editorials, commentaries, case reports, and studies with unclear or low-quality methodology. Initially, we reviewed titles and abstracts. Afterward, we conducted a full-text review of the selected studies. We summarised the results narratively due to the variety of designs, outcomes, and populations across the studies. Figure 1 details the complete study selection process.

3. RESULTS & DISCUSSION

Cardiovascular Risk

Cardiovascular risk is one of the most thoroughly studied side effects of hormonal contraception. It includes the risk of myocardial infarction, ischemic stroke, and venous thromboembolism. The increase in cardiovascular risk is particularly associated with combined hormonal contraceptives, which contain progestin and estrogen. The highest risk of venous thromboembolism was observed among women who used ethinylestradiol-containing contraceptives. Estradiol-containing contraceptives showed lower risk, and contraceptives that contained only progestins did not prove to increase the risk of venous thromboembolism (Heikinheimo et al., 2022). These results are an indication that it is the type of estrogen that contributes to the severity of thrombotic risk. Another study that evaluated the risk of ischemic stroke and myocardial infarction demonstrated that combined hormonal contraceptives were again associated with the highest risk. The study included combined oral contraceptives, the transdermal patch, and the vaginal ring. The progestin-only pill also showed an increased risk, but it was lower. The LNG-IUD did not increase the risk of either ischemic stroke or myocardial infarction (Yonis et al., 2025).

An observational study from France draws attention to the importance of identifying risk factors for myocardial infarction (MI), such as age, smoking status, dyslipidemia, and hypertension, before prescribing combined hormonal contraceptives, as in the study, 86% of the women taking combined oral contraceptives had at least two classical risk factors for MI at the time of experiencing MI (Gompel et al., 2025). Another study on hormonal contraception users who experience migraines has shown that the risk of ischemic stroke varies according to hormonal composition. Hormonal contraceptives with higher doses of estrogen increased the frequency of ischemic strokes (Batur et al., 2023).

The results of these studies lead to the additional conclusion that, although some formulations, especially combined hormonal contraceptives, lead to a higher incidence of cardiovascular events, the absolute risk remains low in healthy women of reproductive age. To provide a more structured and visual comparison of cardiovascular outcomes across different hormonal contraceptive methods, Table 1 presents the key findings from the included studies.

Table 1. Cardiovascular Risk by Hormonal Contraceptive Method

Contraceptive Method	VTE Risk	Arterial Risk (Stroke/MI)	Primary Evidence (Study Type & Source)
COCs	Increased	Increased	Cohort studies (Heikinheimo et al., 2022) (Yonis et al., 2025)
Vaginal Ring	Increased	Increased	Cohort studies (Heikinheimo et al., 2022) (Yonis et al., 2025)
Transdermal Patch	Increased	Increased	Cohort studies (Heikinheimo et al., 2022) (Yonis et al., 2025)

POPs	No increase	Smaller increase	Cohort studies (Heikinheimo et al., 2022) (Yonis et al., 2025)
LNG-IUD	No data in the included studies	No increase	Cohort study (Yonis et al., 2025)

Abbreviations: COCs – combined oral contraceptives; VTE – venous thromboembolism; MI – myocardial infarction.

Breast Cancer Risk

We should not dismiss the possibility of developing breast cancer as a result of using hormonal contraception. However, hormonal contraception is the most effective method of preventing pregnancy (Teal et al., 2021) and helps treat many gynecological disorders, such as endometriosis or polycystic ovary syndrome. Recent studies confirm that the use of hormonal contraception can be the cause of the increased breast cancer risk. Still, the absolute risk is small and varies depending on the formulation. A landmark Danish nationwide cohort study reported an increased relative risk of about 20% in women who were currently or recently using combined oral contraceptives. The risk increased the longer contraception was used and declined after discontinuation. The LNG-IUD showed a similar level of risk. These findings are an important indication that non-oral hormonal delivery systems are not risk-free (Mørch et al., 2017). A large study with meta-analysis confirms that increased breast cancer risk is comparable across both combined and progestin-only methods. The route of administration did not have a significant influence on the results (Fitzpatrick et al., 2023). Results from another study similarly show that the use of combined contraceptives, as well as progestin-only contraceptives, increases the risk of breast cancer. However, the risk magnitude varied depending on the progestin in the formulation. Higher risk was presented among contraceptives with desogestrel and etonogestrel implants. Lower risk was associated with preparations with levonorgestrel.

Overall, the risk of breast cancer caused by hormonal contraception, according to the studies, is small, depending on the formulation and the duration of use. It is not limited to a single method or hormonal component. Moreover, it is crucial to interpret these findings in comparison with the safety profile of hormonal contraception and its benefits.

Mood Changes and Mental Health Effects

The connection between hormonal contraceptives and their influence on mood and the occurrence of depression remains unclear. Recent studies on this subject contradict each other. An observational study conducted in Denmark showed higher use of antidepressants and, similarly, a higher rate of first diagnosis of depression among combined hormonal contraceptives and progestin-only users (Skovlund et al., 2016). However, these rates decreased with age. As opposed to this study, a meta-analysis of 12 randomized controlled trials did not find an association between hormonal contraceptive use and the reported rate of depressive symptoms (de Wit et al., 2021).

In a separate, cross-sectional study, the use of hormonal contraception did not elevate mean depression scores. Nonetheless, some symptoms of depression, such as reduced libido, pessimistic thinking, and sadness, were reported more frequently by women who used hormonal contraception (Sultan et al., 2024). There might be primary factors that determine the future development of depression after hormonal contraception use. These factors include age, age at initiation of contraceptive use, and mental health history (Mengelkoch et al., 2025).

Weight Change and Metabolic Effects

Women using hormonal contraception frequently report weight gain. It is a common reason for its discontinuation (Gallo et al., 2014). Current evidence on weight gain is generally limited, but it suggests that it is not clinically significant. A comprehensive Cochrane review that evaluates progestin-only contraceptives concludes that weight change reported in most of the studies did not exceed 2 kg during the first year of use. In the majority of analyses, there were no significant differences between hormonal contraceptives and non-hormonal methods. However, some differences were found between certain formulations. In particular, depot medroxyprogesterone acetate showed higher long-term increases in body weight and fat composition (Lopez et al., 2016). Nevertheless, the quality of evidence was low.

Studies on metabolic changes caused by drospirenone-containing contraceptives revealed that the most positive impact, with reduced levels of triglycerides and cholesterol, belongs to drospirenone-only contraceptives. Formulations with estrogens, either ethinylestradiol or estriol, appeared to have a mixed impact on lipid metabolism. They improved the ratio of total high-density

lipoprotein cholesterol to total low-density lipoprotein cholesterol. However, they also elevated triglyceride (TG) levels (Regidor et al., 2023).

To summarise, there is no evidence that hormonal contraceptives cause significant weight gain. However, contraceptives containing estrogens appear to have an unfavorable effect on lipid metabolism, which could be a cause of increased cardiovascular risk. In Table 2, we presented a comparative summary of weight-related and metabolic outcomes across different hormonal contraceptive methods.

Table 2. Weight Change and Metabolic Effects by Hormonal Contraceptive Method

Contraceptive Method	Key Findings (Weight & Metabolic Effects)	Primary Evidence (Study Type & Source)
Progestin-only pills (POPs)	Minimal weight change (<2 kg/year); neutral metabolic profile	Cochrane review (Lopez et al., 2016); observational study (Toffol et al., 2025)
Depot medroxyprogesterone acetate (progestin-only injectable)	Greater long-term weight gain and increased body fat composition compared with non-hormonal users	Cochrane review (Lopez et al., 2016)
Combined oral contraceptives (COCs)	Adverse cardiometabolic profile: higher levels of saturated fatty acids, triglycerides, cholesterol in lipoproteins, reduced levels of amino acids	Observational study (Toffol et al., 2025)
Drospirenone-containing contraceptives	Unfavorable metabolic profile of ethinylestradiol-containing formulations compared with natural estrogen-containing formulations and drospirenone-only formulations	Pharmacological review (Regidor et al., 2023)
LNG-IUD	Negligible systemic metabolic impact comparable to non-users	Observational studies (Toffol et al., 2022; 2025)

Abbreviations: POPs – progestin-only pills; LNG-IUD – levonorgestrel intrauterine device

Headaches and Migraine

Headaches are another commonly reported side effect of hormonal contraception. Combined hormonal contraceptives showed a particularly strong association. The phenomenon most extensively studied is estrogen-withdrawal migraine, which occurs during the hormone-free interval. According to the International Classification of Headache Disorders-3, estrogen-withdrawal headache is a headache developing within five days following discontinuation of a course of exogenous estrogens (International Headache Society, 2018). In a prospective diary-based study, the number of migraine days and the severity of pain were significantly higher during the pill-free period. Migraines occurred most often on the 3rd and 4th days of the hormone-free period, and most episodes began during the first four days (Merki-Feld et al., 2020).

Combined oral contraceptives appear to have mixed effects on migraine. They exert positive effects on some women and negative effects on others. However, findings suggest that it may be beneficial for some patients to shorten or even eliminate the hormonal withdrawal period (Vityala et al., 2024). Progestin-only contraceptives appear to have a neutral effect on headaches. Although a French study investigating IUD use identified headaches as a commonly reported side effect, no direct causal relationship was established (Langlade et al., 2019). Furthermore, in another study, the progestin-only pill containing desogestrel 75 μg was linked to fewer migraines, less severe pain, and lower use of pain medication in women with migraine, with or without aura (Merki-Feld et al., 2019). The LNG-IUD likewise decreased the frequency of migraine in some cases. Especially in women who experienced amenorrhea during use (van Lohuizen et al., 2023).

Taken together, the gathered evidence suggests that combined hormonal contraception may cause withdrawal-related migraine. On the other hand, progestin-only methods are less likely to provoke migraine and may even improve symptoms in some women. Table 3 summarizes key findings regarding headache and migraine risk among different contraceptive methods.

Table 3. Headache and Migraine Risk by Hormonal Contraceptive Method

Contraceptive Method	Headache/Migraine Risk	Key Findings	Primary Evidence (Study Type & Source)
Combined Oral Contraceptives (COCs)	↑ Estrogen-withdrawal migraine	Migraine clusters during hormone-free interval; severity increased	Prospective observational study (Merki-Feld et al., 2020); Narrative review (Vityala et al., 2024)
Progestin-Only Pills (Desogestrel)	↓ Reduced migraine frequency	Decrease in migraine frequency, intensity, and medication use	Prospective controlled trial (Merki-Feld et al., 2019)
LNG-IUD	→ Neutral or ↓ improved	Headaches reported but unclear causality, reported reduction in migraine while reaching amenorrhoea	Observational study (Langlade et al., 2019); Review (van Lohuizen et al., 2023)

Abbreviations: LNG-IUD – levonorgestrel intrauterine device; COCs – combined oral contraceptives; ↑ increased risk; ↓ reduced risk; → neutral effect.

This narrative review collects current evidence on the side effect profile of hormonal contraceptives. It reflects on both common and clinically significant adverse effects. The results of the studies included in this review provide a generally clear demonstration that, while hormonal contraception is overall safe, the formulation, route of administration, and characteristics of individual patients play a significant role in the occurrence and severity of side effects.

While discussing the side effects of hormonal contraception, it is difficult not to notice the difference in the safety profiles of estrogen-containing and progestin-only contraceptives. Cardiovascular risk, including venous thromboembolism, ischemic stroke, and myocardial infarction, was highest among estrogen-containing methods. However, it is worth noting that the absolute risk remains low, especially among healthy women. In contrast, most of the studies on progestin-only pills did not report any significant increase in the risk of thrombosis. They reported a smaller increase in the risk of ischemic stroke and myocardial infarction. It is essential, specifically for women who have a smoking history, cardiovascular comorbidities, or migraine with aura, to be aware of these differences in the safety profiles of combined hormonal contraceptives and progestin-only pills, while choosing a form of contraception.

Studies on breast cancer risk showed that, in this area, combined hormonal contraceptives and progestin-only methods, including LNG-IUDs, do not differ significantly. All hormonal contraceptives demonstrate a similar increase in the relative risk of breast cancer. The risk increases with the duration of use and varies depending on the progestin used. Nonetheless, the absolute risk of breast cancer is low, particularly among younger women, and seems to decline after discontinuation. The above studies highlight that it is important, when choosing a method of contraception, to balance potential risk against the many benefits of hormonal contraception.

Research on mood-related side effects of hormonal contraception is still limited. Hormonal contraceptives do not seem to cause a significant increase in depression. However, some subgroups could be more vulnerable to mood changes. Adolescents and women with pre-existing mental disorders appear to be more prone to experiencing depression-like symptoms.

Metabolic effects and weight changes are also frequently reported and are a common reason for discontinuation. The results show that the influence of hormonal contraception on weight gain is generally modest. Some formulations, such as depot medroxyprogesterone acetate, have been associated with greater weight gain than other formulations. Moreover, not all hormonal contraceptives have equal metabolic profiles. Estrogen-containing contraceptives stand out as those with the least favorable metabolic profiles, which may lead to increased cardiovascular risk.

The influence of hormonal contraceptives on headaches and migraines again seems to differ by the type of contraceptive. Studies indicate a strong connection between combined hormonal contraception and estrogen-withdrawal migraine. Most commonly, headaches appear during the hormone-free interval, which supports the theory of the role of estrogen fluctuations in the

pathophysiology of migraine. In contrast, progestin-only methods show a neutral or even beneficial effect on headache symptoms and migraine. Nonetheless, the evidence for its beneficial effects is neither strong nor consistent. Table 4 summarizes key findings regarding differences in side effects between combined hormonal contraceptives and progestin-only contraceptives.

Table 4. Summary of the main differences in side effects between combined hormonal contraceptives and progestin-only contraceptives.

Side Effect	Combined Hormonal Contraceptives	Progestin-Only Methods	Study
Venous thromboembolism (VTE)	Highest increase in risk among hormonal methods; absolute risk remains low in healthy women	No significant increase in risk reported in most studies	Heikinheimo et al., 2022
Ischemic stroke and Myocardial infarction	Increased risk, particularly in women with additional risk factors (e.g., smoking, migraine with aura)	Smaller increase in risk than combined methods	Yonis et al., 2025; Gompel et al., 2025
Overall cardiovascular safety	Less favorable cardiovascular profile	More favorable cardiovascular profile, particularly for women with cardiovascular risk factors	Heikinheimo et al., 2022; Yonis et al., 2025; Gompel et al., 2025
Breast cancer	Similar increase in relative risk; risk rises with duration of use	Similar increase in relative risk, including LNG-IUDs; no major difference compared with combined methods	Skovlund et al., 2016; de Wit et al., 2021; Sultan et al., 2024; Mengelkoch et al., 2025
Depression and mood changes	No significant overall increase in depression; some vulnerable groups may experience symptoms	Similar overall findings; evidence remains limited	Skovlund et al., 2016; de Wit et al., 2021; Sultan et al., 2024; Mengelkoch et al., 2025
Weight gain	Generally modest effect on weight	Generally modest effect; DMPA associated with greater weight gain than other methods	Lopez et al., 2016
Metabolic effects	Least favorable metabolic profile; may contribute to increased cardiovascular risk	More favorable metabolic profile compared with estrogen-containing methods	Regidor et al., 2023; Toffol et al., 2025
Headaches and migraines	Strong association with estrogen-withdrawal migraine	Neutral or potentially beneficial effect, although evidence is inconsistent	Merki-Feld et al., 2020; Vityala et al., 2024; Langlade et al., 2019; Merki-Feld et al., 2019; van Lohuizen et al., 2023

Abbreviations: LNG-IUDs- levonorgestrel-releasing intrauterine devices; DMPA- depot medroxyprogesterone acetate

It is important to acknowledge a few limitations of the evidence included in this review. Many studies were observational. They differed in study populations, contraceptive formulations, and outcome definitions—making direct comparisons between studies complicated. Additionally, certain self-reported outcomes, such as mood changes, are very subjective and not reliably measurable.

Nevertheless, summarizing all the results of the studies included in this review, we provided a fairly consistent background for a better understanding of the safety profile of hormonal contraception.

4. CONCLUSION

Side effects of hormonal contraception are not uniform across all users and methods. They depend not only on the type and composition of the hormone but also on individual patient characteristics. It is crucial to understand these differences for a safe and informed choice when choosing an appropriate method of contraception.

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All authors have read and agreed with the published version of the manuscript.

Informed consent

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Ethical approval

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Conflict of interest

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Data and materials availability

All data associated with this study will be available based on the reasonable request to corresponding author.

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