J Biochem Technol (2026) 17(2): 13-18
https://doi.org/10.51847/rgPNhZBeo3
ISSN: 0974-2328

Implanon Acceptance, Effectiveness and Adverse Effects of Implanon as a Contraceptive among Females in Dhi-Qar, Iraq

Wasan Raheem Mubark Al Khafaji, Aseel Mosa Jabber*, Marwa Habeen Nazzal Eswad

Received: 09 January 2026 / Received in revised form: 29 March 2026, Accepted: 05 April 2026, Published online: 25 May 2026

Abstract

The contraceptive should be highly effective, easy to reverse, have minimal side effects, and require highly compliant patients to be accepted by females and to reduce unplanned pregnancy. Implanon is considered one of the long-acting reversible contraception free from estrogenic side effects. Objectives: To assess acceptance of Implanon as a contraceptive and explore its advantages and adverse effects among users. This prospective study recruited 230 females who wanted an effective contraceptive in Dhi Qar (Iraq) from 2018 to 2024. They enrolled in the study after counselling and accepted the use of Implanon. All patients were asked to record their abnormal symptoms, cycle and weight changes, and were reviewed at 3–6-month intervals, continuing until 6 months post-removal of the implant. 230 females were involved in the study. About 29% of females were overweight, and 71% average weight. Highly effective contraception with a failure rate of about 0.3%. The main side effects were cycle changes in the form of amenorrhea (32%) and irregular bleeding (25%). Eight per cent of patients experience weight gain after insertion. Although other complications were rare, they can occur, like bruising (5%), infection (1%), and loss of libido 6%. No delay in fertility after removal. Several patients discontinued their use early (13%), while other patients were highly satisfied and reinserted the implant after time had passed. Implanon is a highly effective, reversible contraception. Its use is associated with side effects, mainly a change in menstrual loss. Its use was accepted by a large number of females.

Keywords: Implanon, Cycle changes, Contraceptive, Nexplanon

Introduction

An implant for contraception is a long-term birth control method, highly effective and reversible (Espey & Ogburn, 2011; Stoddard *et al*., 2011). One of the progesterone-only contraceptives, primarily present in two types according to their progestin content of levonorgestrel and etonogestrel. These implants are double or single rod. The only currently available implant in Europe (Nexplanon) is a single rod containing 68mg of 3-keto-desogestrel (Ali *et al*., 2017). The duration of its action is about three years. Initially, it releases 60-70 ug/day, and this gradually reduces to around 25-30 ug/day at the end of three years (Cameron & Glasier, 2012). Nexaplanon is radiopaque, an off-white, non-biodegradable implant. This implant is 4 cm in length with a diameter of 2 mm. This soft, flexible progestin implant is inserted subdermally in the inner side of the upper arm (Mommers *et al*., 2012). Subdermal implants can be replaced or removed based on evidence-based duration or at any time according to patient request (Naheed & O'Brien, 2025).

The progestin acts through binding to the progestin receptor located in diverse target cells, which are located along the hypothalamic-pituitary-gonadal genital axis, can interfere with several vital processes required for fertilisation, ovulatory process, partial effect on gonadotrophin surge and significant change in the quality of cervical mucus and even change in endometrial development (Croxatto, 2002). Advantages of progestin implants include long-term contraception, rapid reversibility, no need for patient awareness or compliance, low dose, highly effective without estrogen, and the advantage of improving symptoms of dysmenorrhea and endometriosis (Bahamondes *et al*., 2025). Implanon is associated with a steady level of progestin, and the female continues to have a physiological estrogen level with no effect on bone mineral density (Bennink, 2000; Melkamu Asaye *et al*., 2018).

Known or suspected pregnancy, abnormal uterine bleeding, hepatic carcinoma, and hypersensitivity to any component of Implanon are contraindications to its use (Adams & Beal, 2009). There is a rare possible side effect that can occur with insertion, such as pain or bruising at the site of insertion, a small scar, infection, allergic reactions, and difficulty in removing the implant (Croxatto, 2000). The patient may experience some side effects, and most of them are minor and subside over time, like headache and bloating (Ramdhan *et al*., 2018). Skin changes, mood changes, breast tenderness, and bleeding issues (Adams & Beal, 2009). The main issue is bleeding pattern, and it's the main cause of contraception discontinuation (Mansour *et al*., 2008). Regardless of the type of cycle irregularity, the contraception remains effective (Bhatia *et al*., 2011). The cycle may be significantly changed; about 20 percent have no period, and almost 50 percent

Wasan Raheem Mubark Al khafaji, Aseel Mosa Jabber*, Marwa Habeen Nazzal Eswad
Department of Gynecology and Obstetrics, College of Medicine, University of ThiQar, ThiQar, Iraq.

***E-mail:** aseel-m@utq.edu.iq

will experience prolonged and infrequent spotting (Goto *et al*., 2025).

Materials and Methods

A prospective study was carried out in Dh-Qar in the period between 2018 and 2024. A 230 females, whose age was between 20 and 45 years. All are multiparous women asking for family planning. They enrolled in the study after they chose Implanon as a contraception and gave informed consent to be part of the study.

The patient was excluded from the study if:

1. Amenorrhea or significant cycle irregularity
2. Unexplained vaginal bleeding
3. Suspect pregnancy
4. Liver disease

The Implanon was inserted early in the cycle 3-5 days of the cycle. It's inserted subdermally at medial aspect of non-dominant arm at least 5 cm away from the elbow joint and away from dilated veins if present. Sterilization of skin the sub dermal injection of xylocain (about 0.5 ml) fallowed by application of implanon dressing was used and ask the patient to be removed after 48 hour from application. The couple can resume unprotected intercourse 48 hours after application.

The patients were asked to record their notes about menstrual cycle, body weight, any complications related to insertion like bruising or hormonal side effects like mood changes, cloasma, and decreased libido.

Follow-up visit every 3-6 months during which the adverse effects were assessed, the timing of implant removal, and the cause of removal were recorded. The patients were followed up 6 months after removal to confirm the regaining of normal cycle pattern and fertility, or if patients asked for contraception in the form of an implant or other methods (Altowijri, 2024; Chowdhury *et al*., 2024; Kunie *et al*., 2024; Mohammadi *et al*., 2024; Nguyen *et al*., 2024; Palanikumar *et al*., 2025).

The data was statistically analyzed, and a chi-square test was performed using SPSS.

Results and Discussion

The BMI of Implanon users ranged between 18 and 30; those with morbid obesity were excluded. The 43% of Implanon users have no significant changes in the pattern of menstrual blood loss. While 32% experience amenorrhea, and 25% experience irregular bleeding. Cycle changes were the most distressing side effect and could be the main cause of discontinuation. The 13% of females in our study discontinued the use of Implanon, although they still needed an effective contraceptive **(Figure 1)**.

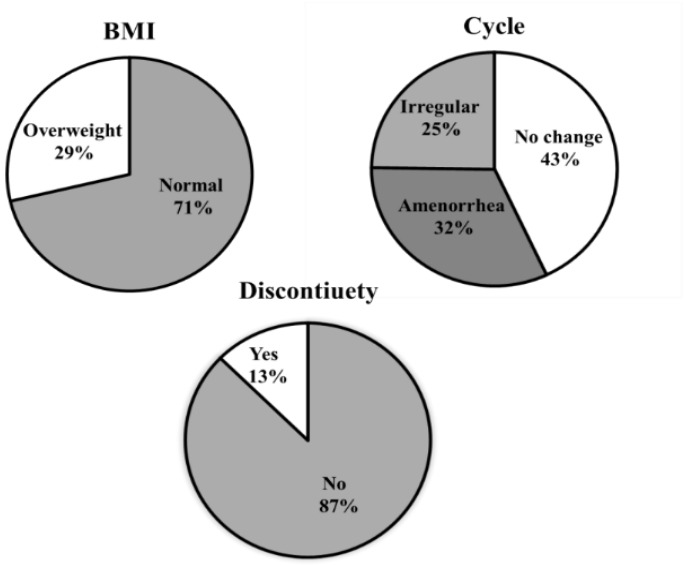

Figure 1. Participant characteristics planning for use of implanon.

This is related to females not accepting certain side effects, which are mostly bleeding or amenorrhea. Eight per cent of users experience significant weight gain (more than 5% from initial weight gain). But this is difficult to attribute purely to Implanon use only. A small number of implanon users experience minor side effects in the form of mood changes 6% and cloasma in 2%. A 5% of user experience development of ovarian cyst. Usually, functional cysts resolve spontaneously, and no intervention is needed.

Most Implanon users do not experience a change in their sexual relations; only six percent experience some degree of loss of libido. Most of the Implanon users (99%) regain fertility immediately after removal. A number of females still want effective contraception for more than three years (the duration of Implanon action). The second Implanon was inserted immediately after the removal of the first one. This indicates high acceptability by the female user **(Figure 2)**.

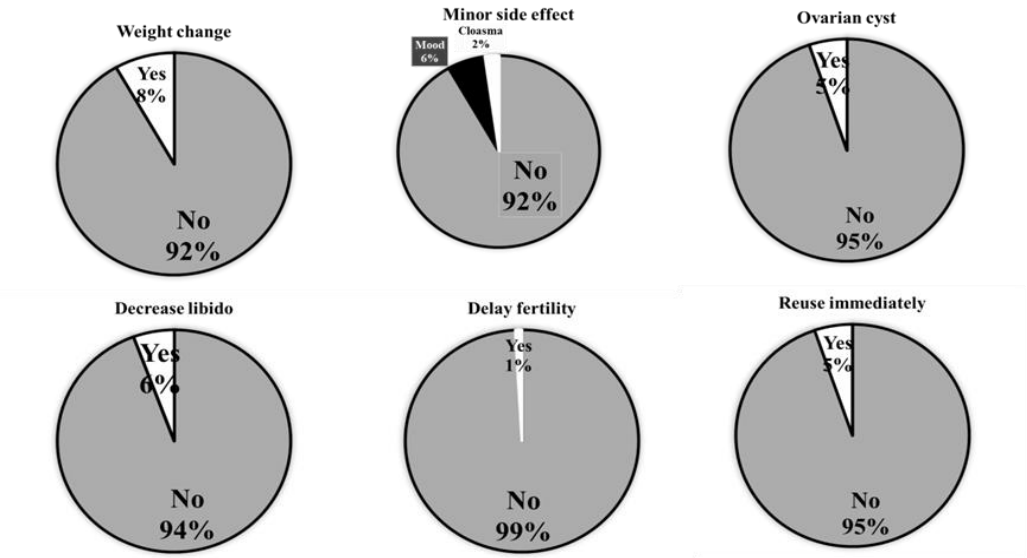

Figure 2. Adverse reactions from implanon use.

Local complications, although rare, can occur. Infections occur in 1% and are treated with antibiotics. And bruises occur in 5%, which resolve. A number of Implanon users experience improvement in dysmenorrhea (23%) and menorrhagia (12%) **(Figure 3)**.

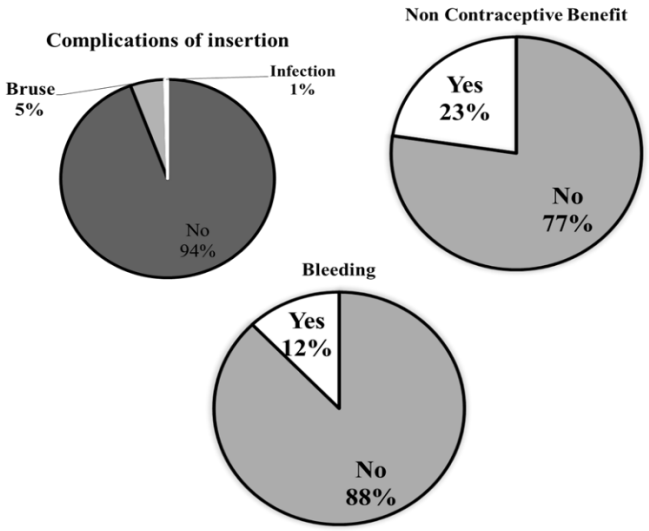

Figure 3. Rate of local complications from implanon use.

Family planning can be achieved by using contraceptives. It reduced unwanted pregnancies, allowed spacing, improved maternal life, and reduced pregnancy-related complications and death. The ideal contraceptive for some patients may not be for others. But in general, the best contraception should be highly efficacious, reversible, have good compliance with no or minimal side effects, and some contraceptives have the advantage of improving other non-contraception conditions like dysmenorrhea and menorrhagia.

In our study, we used implanon, which is a known long-acting contraception, and it has been newly introduced and has become easily accessible in our locality (over the last 10 years). We try to explore its acceptance, advantages, and drawbacks when used by the local female population.

The BMI of females involved in the study was between 18 and 30, an extreme abnormal BMI (those extremely thin and morbidly obese were excluded from the study). Implanon is hormonal contraception and its depend on daily released for approximately fixed dose decrease gradually with time, the extreme weight might affect its efficacy and side effect as the dose selected and tested for female with average BMI. Although there are a number of studies that have confirmed its effectiveness in obese women, like Goto *et al.* found that the contraceptive effectiveness among overweight and obese users reported well within the range of published Pearl

Indices in all weight groups (Goto *et al*., 2025). Eleanor *et al.* found the effectiveness of implants was similar in normal weight, overweight, and obese women (Schwarz, 2012). According to the US selected practice recommendation for contraceptives in 2024, Implanon can be used in obese and normal weight females (Curtis *et al*., 2025; Shapero & Madden, 2025).

Plasma level of etonogestrel was found to be lower in obese than in normal-weight women in the first six months after insertion, but these findings should not be interpreted as low contraceptive efficacy without other consideration (Mornar *et al*., 2012). The failure rate of its use in our study was 0.4%. One patient, and it was a biochemical pregnancy only (failed pregnancy), occurred in an overweight patient, and the patient was on regular use of antiepileptic drugs (Yurievna *et al*., 2023; Abdyrakmanovna *et al*., 2025; Al-Nuaimy *et al*., 2025; Whitaker *et al*., 2025). This percentage is higher than recorded in other studies and may be related to sample size, decreased efficacy in obese patients, or drug interaction. Grentzer *et al.* record 0.05 % failure rate (Vieira *et al*., 2019). Woolrych *et al.* studied over 200 unintended pregnancies with etonorgestel implant; 45 of these were undiagnosed pregnancies prior to insertion, other reasons were incorrect timing of insertion, expulsion of the implanon, and interaction with hepatic enzyme inducer medication (Harrison-Woolrych & Hill, 2005).

There is an 8 percent increase in implant user experience, and an increase in body weight (considered significant when the weight increases by 5% from the initial body weight). While other females have no weight change or have even reduced weight. The relation was unclear and might be a nocebo effect. VC Pam *et al.* found a broad variability in body weight changes in implanon users (Pam *et al*., 2014). Another study linked weight gain in implant users to genetic susceptibility; variants in the ESR1 gene have been associated with weight gain with implant contraception (Butureanu *et al*., 2026). Other clinical research notes that any increase in weight is typically mild and comparable with non-users. Weight fluctuations are more likely related to lifestyle habits, hormonal response, and personal metabolism, rather than implanon itself (Virji, 2017).

The use of implanon is associated with a change in the menstrual cycle pattern, irregular bleeding occurs in 25% of user while 32% of user experienced amenorrhea, and the rest of the user (43%) the continued with a normal cycle pattern. Diana Mansour *et al*. conclude that the use of implanon is associated with unpredictable menstrual patterns, which include amenorrhea, frequent, infrequent or heavy, prolonged loss. And the bleeding pattern of the first three months often reflects the future bleeding pattern of many women (Mansour *et al*., 2008). Several users discontinue their use, although they still need an effective contraceptive (13%). This is usually due to cycle irregularity. Bhatia *et al*. found implanon is a safe and accepted method for contraception, and the discontinuation rate was less than 30 % and related to cycle disturbance (Bhatia *et al*., 2011). Rezan found a discontinuation rate of about 43% and usually related to cycle irregularity (Ali, 2025).

Besides cycle irregularity, there are a number of factors that can be determinants of implanon discontinuation, like nulliparity, educational level, no discussion with partner, no pre-insertion counselling about side effects, and no follow-up appointment (Chekole *et al*., 2023). Several users experienced minor side effects like decreased libido (6%), mood changes (6%), skin changes in the form of cloasma (2%) and ovarian cyst 5%. All these occur in a small percentage and may approximate their percentage in non-implanon users. Rezan found that headaches occur in 23 % and decrease libido in about 19 % of users (Ali, 2025). A pilot study was conducted in eastern Turkey to evaluate the side effects of Implanon and reported mood changes in 17 % and acne in 26%.

Complications of insertion in the form of infection 1 % and bruising in 5% are rare and might be related to individual susceptibility, such as personal immunity. Most local complications are usually easy to manage; also, it's important to differentiate local infection (which is treated with antibiotics) from allergy, which indicates removal of the implant (Chevreau *et al*., 2018). Most females (99%) will resume fertility in the first few months after removal, and this makes it a safe method to be used in those females who desire future fertility (Roberts *et al*., 2015). A significant number of user experience improvements in cycle complications like dysmenorrhea (improved in 23%) and abnormal bleeding (improved in 12%). Several females highly accept this method of contraception and reinsert a new Implanon after removal.

Conclusion

Implanon is a highly effective reversible contraceptive. Well accepted by women despite some side effects. Preinsertion counseling and explanation about side effects and menstrual pattern to improve satisfaction and continuation of the use. Identifying the ideal candidate, i.e., those women who need long-acting estrogen-free reversible contraception and compliance-free. Research with a larger sample size and women with extreme body weight is needed to confirm effectiveness with different body weights. Study with a control group to confirm or refute the association of Implanon use with minor side effects after comparing its occurrence with that of the control group, such as weight gain. Studies focus on non-contraceptive use of Implanon, such as improving dysmenorrhea, menorrhagia, or endometriosis.

Acknowledgments: The authors are grateful to the University of ThiQar for their support to accomplish this study.

Conflict of interest: None

Financial support: None

Ethics statement: The study was approved by the Ethics and Human Research Committee of the Gynaecology & Obstetrics department of the College of Medicine, University of Thi-Qar- Iraq (IRB number: 07/2019). The regulations complied with the ethical standards established in the Declaration of Helsinki for medical research involving human subjects.

References

Abdyrakmanovna, E. A., Esenalievna, A. R., Tumakovich, M. Z., Moldalievich, E. A., & Osmonkulovich, K. N. (2025). Results of the study of alkaline phosphatase activity after dental implantation. *Annals of Dental Specialty, 13*(4), 133–139. doi:10.51847/72xkg45MmE

Adams, K., & Beal, M. W. (2009). Implanon: A review of the literature with recommendations for clinical management. *Journal of Midwifery & Women's Health, 54*(2), 142–149. doi:10.1016/j.jmwh.2008.09.004

Ali, M., Bahamondes, L., & Bent Landoulsi, S. (2017). Extended effectiveness of the etonogestrel-releasing contraceptive implant and the 20 µg levonorgestrel-releasing intrauterine system for 2 years beyond U.S. Food and Drug Administration product labeling. *Global Health, Science and Practice, 5*(4), 534–539. doi:10.9745/GHSP-D-17-00296

Ali, R. A. (2025). Clinical effectiveness and side effect profile of contraceptive implant (Implanon) among women at Sulaimaniyah, Iraq: A cross-sectional study. *BMC Women's Health, 25*(1), 530. doi:10.1186/s12905-025-04072-9

Al-Nuaimy, A. Y. T., Al-Douri, A. S., Mashhadane, F. A. A., & Biswas, R. (2025). Clinical and histological evaluation of serratiopeptidase on oral wound healing in rabbits: In vivo study. *Annals of Dental Specialty, 13*(4), 76–84. doi:10.51847/T8p9K3unVo

Altowijri, A. (2024). Femoral neck fracture with contralateral hip dislocation in a pediatric patient: A case report. *World Journal of Environmental Biosciences, 13*(4), 34–38. doi:10.51847/ayYys3AeIl

Bahamondes, L., Bahamondes, M. V., & Juliato, C. R. T. (2025). Subdermal contraceptive implants. *Best Practice & Research Clinical Obstetrics & Gynecology, 100*, 102604. doi:10.1016/j.bpobgyn.2025.102604

Bennink, H. J. T. C. (2000). The pharmacokinetics and pharmacodynamics of Implanon®, a single-rod etonogestrel contraceptive implant. *The European Journal of Contraception & Reproductive Health Care, 5*(2), 12–20. doi:10.1080/13625187.2000.12067162

Bhatia, P., Nangia, S., Aggarwal, S., & Tewari, C. (2011). Implanon: Subdermal single rod contraceptive implant. *The Journal of Obstetrics and Gynecology of India, 61*(4), 422–425. doi:10.1007/s13224-011-0066-z

Butureanu, T., Apetrei, A. M., Balan, R. A., Haliciu, A. M., Pavaleanu, I., Socolov, D., & Socolov, R. (2026). Contraceptive-induced weight gain—myth and reality review. *Life, 16*(4), 553. doi:10.3390/life16040553

Cameron, S. T., & Glasier, A. (2012). Contraception and sterilization. In *Dewhurst's Textbook of Obstetrics & Gynaecology* (pp. 495–512). John Wiley & Sons, Ltd. doi:10.1002/9781119979449.ch40

Chekole, M. S., Zikie, D. T., Wogie Fitie, G., Taye, B. T., Kibiret, D. M., Silesh Zerihun, M., Moltot Kitaw, T., Ali, M. A., Legasu, T. D., Assefa, K. T., et al. (2023). Determinants of Implanon discontinuation among women who use Implanon at Debre Berhan town public health institutions in Northeast Ethiopia: A case–control study. *Frontiers in Global Women's Health, 4*. doi:10.3389/fgwh.2023.961364

Chevreau, J., Krief, D., Abou Arab, O., Zitoun, M., Foulon, A., Sergent, F., & Gondry, J. (2018). Factors associated with removal difficulties of etonogestrel-containing contraceptive implants (Nexplanon®). *European Journal of Obstetrics & Gynecology and Reproductive Biology, 224*, 81–84. doi:10.1016/j.ejogrb.2018.03.019

Chowdhury, F., Dube, R., Riyaz, R., Khan, K., Al-Zuheiri, S. T. S., & Rangraze, I. R. (2024). Efficacy of metformin as monotherapy in gestational and pre-gestational diabetic pregnant women. *Journal of Advanced Pharmacy Education & Research, 14*(2), 84–90. doi:10.51847/QoUS4cqLD6

Croxatto, H. B. (2000). Clinical profile of Implanon®: A single-rod etonogestrel contraceptive implant. *The European Journal of Contraception & Reproductive Health Care, 5*(sup2), 21–28. doi:10.1080/14730782.2000.12288982

Croxatto, H. B. (2002). Mechanisms that explain the contraceptive action of progestin implants for women. *Contraception, 65*(1), 21–27. doi:10.1016/S0010-7824(01)00294-3

Curtis, K. M., Nguyen, A. T., Tepper, N. K., & Whiteman, M. K. (2025). Using updated clinical recommendations to support contraceptive decision-making: U.S. medical eligibility criteria for contraceptive use, 2024. *Contraception, 111015*. doi:10.1016/j.contraception.2025.111015

Espey, E., & Ogburn, T. (2011). Long-acting reversible contraceptives: Intrauterine devices and the contraceptive implant. *Obstetrics & Gynecology, 117*(3). https://journals.lww.com/greenjournal/fulltext/2011/03000/long_acting_reversible_contraceptives_.25.aspx

Goto, D., Grunden, J. W., Klinghardt, M., Patel, V. P., von Stockum, S., Barnett, C., & Bitzer, J. (2025). Effectiveness of the etonogestrel subdermal implant in users with overweight and obesity: A systematic literature review. *BMJ Sexual & Reproductive Health, 51*(4). doi:10.1136/bmjsrh-2024-202424

Harrison-Woolrych, M., & Hill, R. (2005). Unintended pregnancies with the etonogestrel implant (Implanon): A case series from postmarketing experience in Australia. *Contraception, 71*(4), 306–308. doi:10.1016/j.contraception.2004.10.005

Kunie, K., Kawakami, N., Shimazu, A., Yonekura, Y., & Miyamoto, Y. (2024). Studying the role of managers' communication behaviors in the relationship between nurses' job performance and psychological empowerment. *Journal of Organizational Behavior Research, 9*(1), 151–161. doi:10.51847/OXN9xWb1Ub

Mansour, D., Korver, T., Marintcheva-Petrova, M., & Fraser, I. S. (2008). The effects of Implanon® on menstrual bleeding patterns. *The European Journal of Contraception & Reproductive Health Care, 13*(sup1), 13–28. doi:10.1080/13625180801959931

Melkamu Asaye, M., Syoum Nigussie, T., & Mequannt Ambaw, W. (2018). Early Implanon discontinuation and associated factors among Implanon user women in Debre Tabor Town, public health facilities, Northwest Ethiopia, 2016. *International Journal of Reproductive Medicine, 2018*(1), 3597487. doi:10.1155/2018/3597487

Mohammadi, R. G., Rajaei, E., Ghanbaran, A., Fatemi-Behbahani, S. A., & Mowla, K. (2024). Pregnancy and neonatal outcomes in pregnant patients with inflammatory arthropathy treated by etanercept; Retrospective study. *Journal of Advanced Pharmacy Education & Research, 14*(2), 58–62. doi:10.51847/6tZIJUi9kV

Mommers, E., Blum, G.-F., Gent, T. G., Peters, K. P., Sørdal, T. S., & Marintcheva-Petrova, M. (2012). Nexplanon, a radiopaque etonogestrel implant in combination with a next-generation applicator: 3-year results of a noncomparative multicenter trial. *American Journal of Obstetrics and Gynecology, 207*(5), 388.e1–388.e6. doi:10.1016/j.ajog.2012.08.002

Mornar, S., Chan, L.-N., Mistretta, S., Neustadt, A., Martins, S., & Gilliam, M. (2012). Pharmacokinetics of the etonogestrel contraceptive implant in obese women. *American Journal of Obstetrics and Gynecology, 207*(2), 110.e1–110.e6. doi:10.1016/j.ajog.2012.05.002

Naheed, B. K. J. H. O. F., & O'Brien, P. M. S. (2025). Gonadotropin-releasing hormone (GnRH) analogues for premenstrual syndrome (PMS). *Cochrane Database of Systematic Reviews, 6*. doi:10.1002/14651858.CD011330.pub2

Nguyen, N. P., Pham, T. H., & Nguyen, N. H. (2024). The effect of financial autonomy on medical treatment in central public hospitals in Vietnam. *Journal of Organizational Behavior Research, 9*(2), 95–104. doi:10.51847/M1JcunFDqY

Palanikumar, K., Manivel, N., & Rajendren, S. (2025). Traditional medicinal plants utilization by tribal communities in Kalvarayan Hills of Tamil Nadu: An analysis utilization of medicinal plants. *World Journal of Environmental Biosciences, 14*(4), 8–13. doi:10.51847/6zF2sayMXB

Pam, V. C., Musa, J., Mutihir, J. T., Karshima, J. A., Anyaka, C. U., & Sagay, A. S. (2014). Body weight changes in women using Implanon in Jos, Nigeria. *African Journal of Medicine and Medical Sciences, 43*(Suppl), 15–21.

Ramdhan, R. C., Simonds, E., Wilson, C., Loukas, M., Oskouian, R. J., & Tubbs, R. S. (2018). Complications of subcutaneous contraception: A review. *Cureus, 10*(1), 1–7. doi:10.7759/cureus.2132

Roberts, A. O., Morhason-Bello, I. O., Okunlola, M. A., & Adekunle, A. O. (2015). Profile of Implanon® acceptors and pattern of side effects. *Journal of Reproduction and Contraception, 26*(1), 46–52. doi:10.7669/j.issn.1001-7844.2015.01.0046

Schwarz, E. (2012). The contraceptive implant: A good option for overweight and obese women. *NEJM Journal Watch*. doi:10.1056/WH201207120000005

Shapero, K., & Madden, T. (2025). The 2024 US medical eligibility criteria for contraceptive use: Application to practice in the care of patients with cardiac disease. *Circulation Research, 136*(6), 566–582. doi:10.1161/CIRCRESAHA.125.325682

Stoddard, A., McNicholas, C., & Peipert, J. F. (2011). Efficacy and safety of long-acting reversible contraception. *Drugs, 71*(8), 969–980. doi:10.2165/11591290-000000000-00000

Vieira, C. S., de Nadai, M. N., de Melo Pereira do Carmo, L. S., Braga, G. C., Infante, B. F., Stifani, B. M., Ferriani, R. A., & Quintana, S. M. (2019). Timing of postpartum etonogestrel-releasing implant insertion and bleeding patterns, weight change, 12-month continuation and satisfaction rates: A randomized controlled trial. *Contraception, 100*(4), 258–263. doi:10.1016/j.contraception.2019.05.007

Virji, A. (2017). Effects of contraceptives on weight gain or loss. *American Family Physician, 96*(12), 1–15.

Whitaker, J. R., Wei, L., & El Sherif, A. K. (2025). Alveolar bone biology under orthodontic loading: Mechanotransduction and cellular responses. *Asian Journal of Periodontics & Orthodontics, 5*, 267–276. doi:10.51847/0cOWNtVJpb

Yurievna, L. E., Mikhailovich, P. V., Tokhiriyon, B., Nikolaevna, D. N., Anatolyevna, P. G., & Yurievich, L. N. (2023). A comparative evaluation of "Cerafill" and "iRoot" bioceramic sealers: Mechanical and chemical insights. *Asian Journal of Periodontics & Orthodontics, 3*, 12–17. doi:10.51847/xwOhbZsqp0