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REVIEW

Effects of Ashwagandha on Reproductive Health: A Systematic Review of Sex-Specific Hormonal and Fertility Outcomes

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ABSTRACT

Reproductive health is a major component of overall well-being, which is regulated by various factors like nutrition, stress and lifestyle; all of these in turn influence fertility and sexual function. Ideal reproductive health requires constant upkeep in individuals of both males and females, with natural products like ashwagandha gaining significant attention for their potential advantages. Various studies are exploring the effect of ashwagandha in the reproductive systems of both males and females. These studies are emphasizing some specific parameters like polycystic ovary syndrome, stress-induced menstrual irregularities in the case of the female reproductive system and sperm count and quality in the case of the male reproductive system. In order to study the impact of ashwagandha on the reproductive system, we conducted a systematic review involving a search of major databases like MEDLINE/PubMed, Web of Science, Scopus, Science Direct, and Google Scholar, following PRISMA guidelines. Our review included a detailed analysis of preclinical and clinical research articles that evaluated the role of ashwagandha in improving reproductive health and sexual dysfunction. This study specifically looked at its impact on the reproductive system. The findings of this study indicate that ashwagandha has the potential to improve sexual health. It can also serve as a therapeutic agent in certain reproductive disorders due to its antioxidant nature. In conclusion, ashwagandha appears to be a promising natural adjunct to the enhancement of reproductive health; however, more study is needed to understand its long-term effects and dosing more fully.

1 | Introduction

Withania somnifera, or Ashwagandha, is a commonly used therapeutic herb, and has been recognized and described as offering a wide and varied array of health benefits, including, but not limited to, decreasing stress, modulating immunity, and other cognitive positives. *W. somnifera*, or Ashwagandha, has been used historically in many ways, but it has been noted for its use in reproductive health, promoting fertility, and its names “Indian ginseng,” and “Rejuvenator,” or “Rasayana” (Mikulska et al. 2023; Petre et al. 2023). In Ayurveda, ashwagandha is said to increase vital energy, restore hormonal balance, and rectify male and female reproductive issues. Much of this has been proven by recent scientific studies where the adaptogen-like and modulation properties of the plant are evident (Paul et al. 2021; Speers et al. 2021; Puttaswamy et al. 2025). Ashwagandha is a widely recognized dietary supplement globally and the amount of global growth in

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popularity is like wildfire in North America and Europe. This growth alongside the increasing demand for natural products to treat or manage reproductive and hormonal disorder conditions, is significant (Mandlik and Namdeo 2021; Baghel and Srivastava 2021; Lopresti and Smith 2021). Products derived from ashwagandha are presently being promoted quite heavily with claims that they will boost testosterone, improve sperm quality, reduce menstrual cycle issues, and improve a person's ability to have children (Morgado et al. 2024; Mutha, Mutha, Tejuja, and Langade 2025). After all these claims, some questions about safety, long-term effects, and gender-specific effects arose and need to be examined thoroughly with sound science (Sprengel et al. 2025; Chauhan et al. 2022; Roy, Ghosh, and Rangra 2024; Roy, Brar, et al. 2024; Roy, Kaur, et al. 2024).

When it comes to contributing to reproductive well-being, Ashwagandha is linked to a number of complicated mechanisms, one being the maintenance of the hypothalamic–pituitary–gonadal axis (Welch et al. 2023). In males, clinical and preclinical studies have been favorable in relation to stimulation of testosterone synthesis, improvements in sperm characteristics and a general reduction in stress-induced sterility (Corradi et al. 2016; Guo and Rezaei 2024; Lucius 2025) For females, similar excitement has been noted in terms of restoration of hormonal balance, improvements in initiation of ovulation, and outcomes of polycystic ovary syndrome (PCOS) (Roy, Ghosh, and Rangra 2024; Roy, Brar, et al. 2024; Roy, Kaur, et al. 2024; Thull et al. 2025; Verma et al. 2023). Regardless of these advances, important knowledge gaps remain in understanding the gender-specific effects of ashwagandha, mechanisms of action, and safety when used long-term (Parker et al. 2022; Teede et al. 2010; Gupta and Srivastava 2025). The gender-specific differences in hormonal systems, reproductive physiology, and susceptibility to undesirable effects necessitate the urgent and necessary gender-comparative analysis of the effects of Ashwagandha on male and female reproductive health (Kalaiselvan et al. 2025; Ossowska et al. 2025; Sikorski et al. 2024). This generates a need to further explore the safety profile of Ashwagandha, particularly among vulnerable populations such as pregnant women, individuals with hormonal dysregulation, and users taking higher doses for prolonged periods of time (Azgomi, Zomorrodi, et al. 2018; Azgomi, Nazemiyeh, et al. 2018; Roy, Ghosh, and Rangra 2024; Roy, Brar, et al. 2024; Roy, Kaur, et al. 2024; Wiciński et al. 2023; Skrzypiec-Spring et al. 2025).

The objective of this systematic review is to provide a complete analysis of Ashwagandha's effects on reproductive health and outcomes with attention to hormonal modulation and fertility trajectories. This paper will discuss the herb's modes of action in reproductive physiology, examine the effects of Ashwagandha on female reproductive health including hormonal regulation, ovulation, and fertility outcomes assess the effect of Ashwagandha on male reproductive health including testosterone production, sperm quality, and fertility outcomes; and highlight the gender-based differences prevalent in the literature investigating the effects of Ashwagandha on reproductive health. This systematic review aims to provide an evidence-based perspective of Ashwagandha and its effect on reproductive health by synthesizing evidence from clinical trials, preclinical studies and case reports. Additionally, it will identify gaps in the literature and make suggestions for future studies to clarify the potential therapeutic uses and safety of Ashwagandha.

2 | Methodology

This review is conducted as Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement (Moher et al. 2009).

2.1 | Literature Sources and Strategy

The data related to the effect of ashwagandha on male and female reproductive health have been collected from recognized databases, including MEDLINE/PubMED, Web of Science, Scopus, Science Direct and Google Scholar using the keywords "ashwagandha + male reproductive health," "ashwagandha + female reproductive health," "ashwagandha+ hormonal effect," "ashwagandha + fertility enhancement," "ashwagandha+ reproductive health" from 2009 to 2024. The most pertinent and thorough literature search was conducted. A total of 1200 research and review studies were initially screened, and out of these 107 were selected based on the effect of ashwagandha on male and female reproductive health. Only free open-access literature and English literature were used.

2.2 | Study Selection

Two authors have screened all titles and abstracts independently. Inclusion and exclusion criteria were used to screen the studies and the criteria are listed in Table 1. We only included the most recent or comprehensive study when there were several or duplicate publications of the same dataset.

2.3 | Management of Extracted Data

DR and MG initially independently assessed the abstract and title of each paper. One of the metrics listed in the selection criteria had to be covered by each of the selected publications. Regarding the in vivo, in vitro and clinical tests, no replication or disagreement data are provided. Any literature duplication was avoided.

TABLE 1 | Inclusion and exclusion criteria of the articles in this review.

	Inclusion criteria	Exclusion criteria
Study design	Articles (Review or Research) that describe the effect of ashwagandha on reproductive health (either sex)	Invalid data, unauthorized source
Population	Subjects with sexual dysfunction being treated by ashwagandha or improved sexual health	N/A

2.4 | Analysis

On the basis of inclusion and exclusion criteria, 107 studies have been included for further analysis as presented in Figure 1. The data related to the effect of ashwagandha on male and female reproductive health have been extracted from these 107 studies and compiled in Tables 3–6. The level of evidence regarding the effect of ashwagandha on male and female reproductive health has been categorized as in vitro studies, in vivo, and clinical studies.

3 | Results

3.1 | Literature Search

A preliminary literature search turned up 1200 publications that might be connected. The analysis removed 400 publications because they were duplicates and were not open access. Four hundred and fifty articles were eliminated based on the title and information in abstract after the remaining 350 were further assessed using the data from the abstracts and titles. Fifty two were not retrieved due to the lack of full-text information, out of the approximately 350 that were sought for retrieval. Out of the 136 articles that were evaluated for eligibility, almost 29 were eliminated because of inadequate and irrelevant data. The final 107 articles qualified for the systematic review and debate since they were full texts.

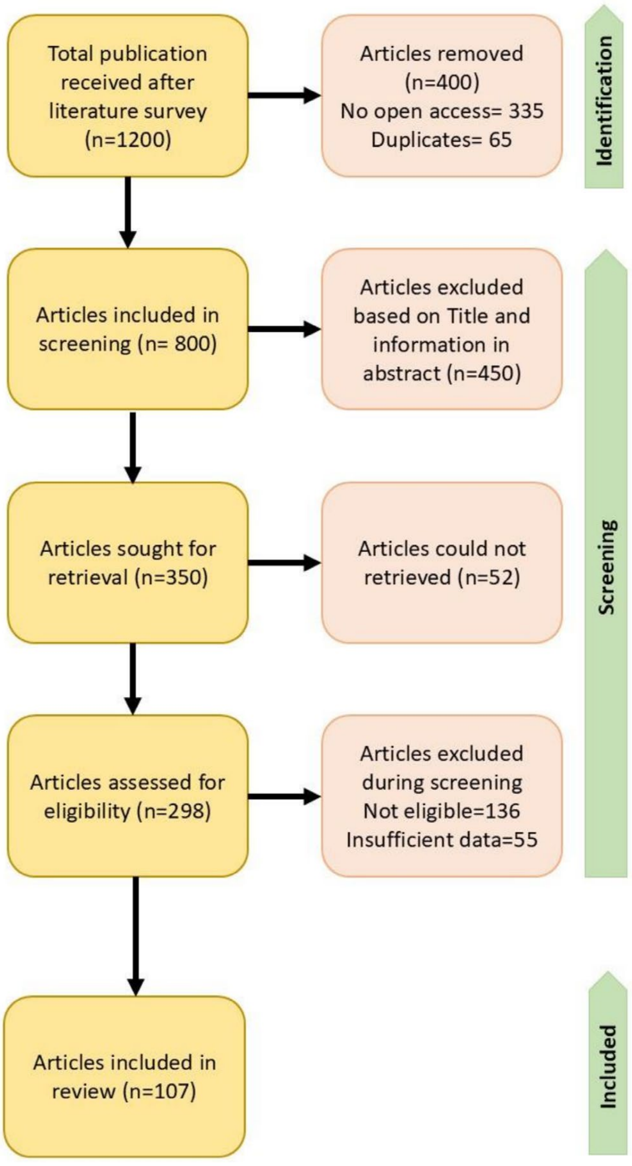

FIGURE 1 | PRISMA 2020 Flow diagram for the literature screening.

3.2 | Characteristics of Included Studies

We identified 107 articles based on the mechanism of action of ashwagandha, effects of ashwagandha on male reproductive health and effects of ashwagandha on female reproductive health.

4 | Discussion

4.1 | Mechanism of Action in Reproductive Health

Mechanisms of ashwagandha on reproductive health are primarily conducted through several physiological and biochemical means mainly to impact hormonal balance, stress, and oxidative stress (Gómez Afonso et al. 2023; Mikulska et al. 2023). These are important understandings, for instance, in ascertaining possible therapeutic advantages, as well as in the safety profile of such treatment in male and female reproductive health. Below, we outline the main pathways of its mechanism (Ambiye et al. 2013).

Pharmacological properties have been assigned to the bioactive components, mainly withanolides, a class of steroidal lactones. The group consists of many compounds, such as withaferin A, withanolide D, and many other alkaloids like somniferine (Abdelwahed et al. 2023; Kumar, Dey, et al. 2015; Kumar, Ali, et al. 2015; Kumar, Kumar, et al. 2015; Nile et al. 2022; Sukumar et al. 2020). Effect of ashwagandha in female and male reproductive health has shown in Figure 2. The major activities of the bioactive constituents include:

4.1.1 | Hormonal Modulation via the HPG Axis

The overall impact of ashwagandha on levels of reproductive hormones is founded upon its influence on the hypothalamic–pituitary-gonadal axis. It is an essential mediator of reproductive processes in both female and male (Gómez Afonso et al. 2023).

Among male, it increases the rate of synthesis of testosterone through stimulation of luteinizing hormone secretion from the anterior pituitary gland which later stimulates leydig cells located in the testes to produce testosterone (Roychoudhury et al. 2021). This reduces cortisol, whereby the stress-induced suppression of testosterone synthesis is consequently reduced (Baghel, Azam, et al. 2023).

Similarly in female, ashwagandha can even help with balancing levels of progesterone and estrogen, especially in cases of hormonal imbalances, such as in PCOS. Stress modulation may indirectly lead to an increase in the levels of gonadotropin and thus facilitate the growth of follicles and ovulation (Baghel,

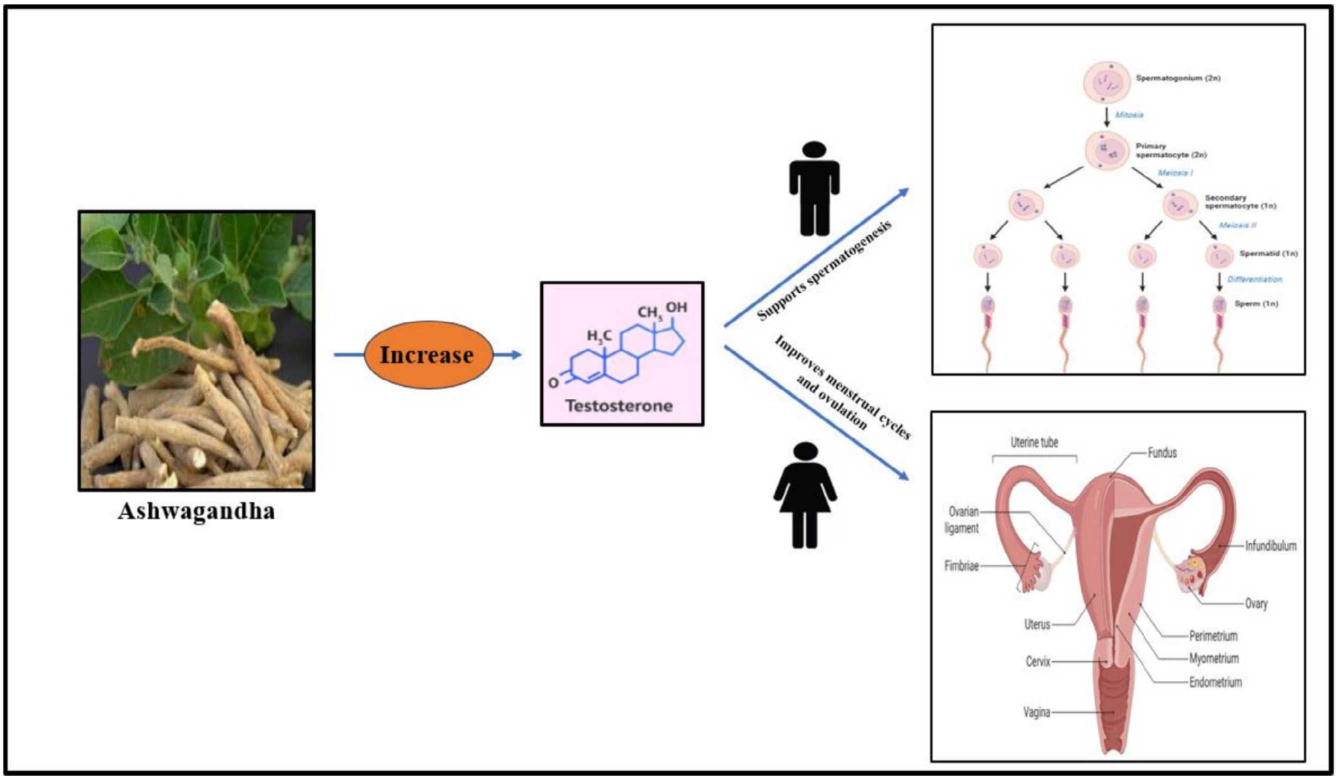

FIGURE 2 | Effect of ashwagandha on female and male reproductive health.

Niranjan, and Srivastava 2023). The data for further studies are shown in Table 2.

4.1.2 | Adaptogenic Properties and Stress Reduction

Stress is one of the most significant causes of infertility and hormonal imbalances in both males and females. Ashwagandha is an adaptogen that helps the body to cope with stress by modulating the hypothalamic–pituitary–adrenal (HPA) axis (Salve et al. 2019; Priyanka et al. 2020; Devarasetti et al. 2024; Gladen-Kolarsky et al. 2024; Kaspate et al. 2015).

Ashwagandha has been known to reduce cortisol, which is a hormone that suppresses the production of reproductive hormones. A reduction in cortisol will help males increase testosterone and females re-establish menstrual regularity (Haber et al. 2024; Kuśmierska et al. 2024; Platzbecker et al. 2023; Leonard et al. 2024).

It has been established in animal models and clinical studies that Ashwagandha supplementation helps in improving stress-related infertility mainly by restoring hormonal balance and reducing oxidative damage to reproductive tissues (Arumugam et al. 2024; Pande 2023; Sobota et al. 2024). The data for the further studies have shown in Table 2.

4.1.3 | Antioxidant and Anti-Inflammatory Effects of Ashwagandha

Certain lifestyle choices can easily create oxidative stress, resulting in poor quality sperm and oocytes, and ultimately infertility. In this light, this mechanism of action can be compared to that of an antioxidant (Walke et al. 2023).

In male, it contains antioxidant properties that protect the spermatozoa from oxidative damage and enhance parameters like sperm count, motility, and morphology. ROS decrease has been associated with the enhancement of DNA integrity of the sperms (Sikandan et al. 2018; KrishnaRaju et al. 2023; Tamoli et al. 2022; Srivastav and Das 2014).

In female, Antioxidant activity prevents oxidative damage to ovarian follicles, thus enhancing the quality of the oocytes and chances of successful fertilization (Saha et al. 2024). The anti-inflammatory property helps to treat inflammatory reproductive issues like endometriosis, among others (Khan et al. 2015; Azab et al. 2022; Wiciński et al. 2024). The data for the further studies have shown in Table 2.

4.1.4 | Cellular and Molecular Pathways of Ashwagandha Acting on Reproductive Health

Recent studies have elucidated many cellular pathways through which ashwagandha acts and that are relevant to reproductive health like It can improve 17β-hydroxysteroid dehydrogenase to impact enzymes involved in the steroid hormone biosynthesis which raises the rate of testosterone and oestradiol in the body (Kołodziejska et al. 2024; Ahmed et al. 2018; Wang et al. 2021; Sangwan et al. 2014). It reduces the level of ROS and, thus protects mitochondrial functions in gonadal cells (Shah et al. 2015; Tripathi et al. 2017; D'Cruz and Andrade 2022). That means there is energy supplied to spermatogenesis and oogenesis. In females, ashwagandha

TABLE 2 | Different mechanisms of ashwagandha helping to impact reproductive health.

Mechanism of action	Description	Impact on reproductive health	Sex-specific notes	References
Hormonal modulation	This impacts the hypothalamic–pituitary-gonadal (HPG) axis, which controls sex hormones including testosterone, estrogen, and progesterone.	It raises the levels of testosterone and luteinizing hormone (LH) in males.	Balances estrogen and progesterone levels in female. Hyperproduction of testicular testosterone supports spermatogenesis in male. Hormonal balance improves menstrual cycles and ovulation in female.	Gómez Afonso et al. (2023), Roychoudhury et al. (2021), Baghel, Azam, et al. (2023), and Baghel, Niranjan, and Srivastava (2023)
Stress reduction	It lowers cortisol concentration by influencing the hypothalamic–pituitary–adrenal (HPA) axis.	Reduces stress-induced suppression of reproductive hormones.	Improves fertility because it decreases hormonal imbalance caused by stress and male testosterone needs stress to be reduced. It creates menstrual regularity and gonadotropin release in female.	Salve et al. (2019), Priyanka et al. (2020), Devarasetti et al. (2024), Haber et al. (2024) Kuśmierska et al. (2024) Platzbecker et al. (2023), and Leonard et al. (2024)
Antioxidant activity	It scavenges ROS and thus antioxidant-based protective action against oxidative stress.	It improves sperm motility, morphology, and DNA integrity. This improves the oocyte's health and ovarian function.	Male sperm are susceptible to oxidative stress. It protects the ovarian follicle from ROS damages and chances of successful fertilization.	Walke et al. (2023), Sikandan et al. (2018), KrishnaRaju et al. (2023), Tamoli et al. (2022), Srivastav and Das (2014), and Khan et al. (2015)
Anti-inflammatory effects	Reduces inflammation of the reproductive tissues.	It protects against inflammation-related reproductive disorders, such as prostatitis in males and endometriosis in females.	It reduces inflammation in testicular tissues. Relieves inflammation in ovarian and uterine conditions.	Azab et al. (2022), Wiciński et al. (2024), and Saha et al. (2024)
Steroidogenesis regulation	Modulates the enzymes involved in the synthesis of steroid hormones such as testosterone and oestradiol.	It promotes biosynthesis of sex hormones. It enhances gonadal function and fertility.	Promotes testosterone synthesis in males. Enhances oestradiol and progesterone production critical for ovulation and implantation in females.	Kołodziejska et al. (2024), Ahmed et al. (2018), Wang et al. (2021), Sangwan et al. (2014), and Prabhu (2022)
Gonadal oxidative stress control	Protects mitochondrial function in gonadal cells through reduction of oxidative damage.	This will increase energy production for spermatogenesis and oogenesis. Maintains integrity in the reproductive cells and tissue.	It protects sperm mitochondria and increases motility. It protects oocytes and the follicular cells from oxidative damage.	Sengupta et al. (2018), Malik et al. (2022), D'Cruz and Andrade (2022), and Sobota et al. (2024)

(Continues)

TABLE 2 | (Continued)

Mechanism of action	Description	Impact on reproductive health	Sex-specific notes	References
Adaptogenic properties	Increases the adaptability of body towards stress, ensuring there is no disruption in hormonal homeostasis.	Increases the adaptability of body towards stress, ensuring there is no disruption in hormonal homeostasis.	It supports testosterone recovery in males under chronic stress. Restores the balance of gonadotropin and ovarian hormones in females experiencing stress-induced infertility.	Arumugam et al. (2024), Pande (2023), and Kaspate et al. 2015
Follicular development support	Induction of gonadotropin signalling through the maturation of ovarian follicles.	It improves ovulation and oocyte quality, hence enhancing the fertility outcomes in female.	Not applicable for male. It directly enhances female ovulation and fertility by improved follicular response to LH and FSH.	Bhattarai et al. (2010) and Barua et al. (2013)
Neuroendocrine effects	Modulates neuroendocrine pathways that influence sexual behavior and libido via the dopaminergic and serotonergic systems.	Enhance sexual arousal and performance. It improves general reproductive health.	Evidence of better erectile function and libido in male. It has an effect on libido and sexual dysfunction in females.	Fry et al. (2022) and Haber et al. (2024)

stimulates follicular development by enhancing gonadotropin signaling, which is an important process in ovarian physiology (Yadav and Mishra 2024; Satkar et al. 2024). The data for further studies are shown in Table 2.

4.1.5 | Safety Mechanisms and Homeostatic Effects

Ashwagandha acts "homeostatically," meaning that it seeks to restore rather than elevate the level of hormones above the natural range. This is exactly what might be dangerous in vulnerable populations (Smith et al. 2023; Mandlik and Namdeo 2021; Verma et al. 2021).

Ashwagandha, unlike synthetic hormones, seems to enhance natural hormone production without any tendency to cause hyperactivity (Megahd and Gabal 2021). Support to Vulnerable Groups Preliminary studies suggest that there are little harmful effects on the reproductive organs among the healthy; further studies should be conducted to establish its safety in pregnant and endocrine-related disorders patients (Raut et al. 2012; Prabhu 2022). The data for the further studies have shown in Table 2.

4.2 | Effects on Male Reproductive Health

It has scientifically been studied concerning the effect of ashwagandha on male reproductive health, thus showing very important benefits in hormone regulation, enhancement of fertility, and quality of sperms.

4.2.1 | Hormonal Effects

One of the main functions ashwagandha has in males is by how it alters hormones via its adaptive and steroidogenesis process. Ashwagandha increases the activity of hypothalamic–pituitary-gonadal, thus increasing the production of testosterone by enhancing the secretion of luteinizing hormone that acts on Leydig cells in the testes. Reduction in cortisol levels also indirectly supports testosterone production, as chronic stress and elevated cortisol are known to suppress testosterone synthesis (Wiciński et al. 2023; Roychoudhury et al. 2021). It has been reported that ashwagandha extract treatment clinically caused a significant increase in both follicle-stimulating hormone (FSH) and luteinizing hormone (LH) and in males; thus, the herb was indicated to improve overall testicular function. The last 5 years have witnessed a considerable amount of research on ashwagandha for its possible impact on male reproductive hormones, such as testosterone, luteinizing hormone (LH), and cortisol (Mikulska et al. 2023).

Recent findings from in vitro, in vivo and clinical studies provide strong proof for its contribution to better hormonal health. In Streptozotocin-induced diabetic male Wistar rats, ashwagandha supplementation increased testosterone, LH, and progesterone levels in non-diabetic treated mice and lowered serum FSH levels in both the non-diabetic and diabetic groups. Furthermore, ashwagandha also reversed the diabetes-induced lowering of progesterone levels (Kiasalari et al. 2009). A prospective clinical study on infertile males aged 25–40 years had shown a significant increase in serum testosterone and LH and also reduced the level of FSH and prolactin at a dose of 5 g/day of ashwagandha root powder (Ahmad et al. 2010). There was a rise in LH, and it decreased the cortisol and FSH levels in 3 months among 60 normozoospermic infertile males on supplementation with ashwagandha root powder of 5 g/day/PO along with milk. It was also observed that there was an increase of 14% in the rate of success of pregnancy in the partners due to an increase in sperm concentration (<0.01 and <0.05) and decreased liquefaction time (<0.01 and <0.05) (Mahdi et al. 2011).

Study also has shown that the root powder of ashwagandha shows a significant increase in testosterone and LH and a decrease in triglyceride and FSH levels in adult male albino rats (Belal et al. 2012). The end points of 90 days improved the group of 46 oligospermic males with an increase of 167% in sperm count, 57% sperm motility, and 53% in semen volume through the use of ashwagandha root extract at 675 mg/day (225 mg/thrice a day/PO) dose for 90 days (Ambiye et al. 2013). In a study conducted on 180 infertile males, supplementation with ashwagandha root powder at 5 g/day single dose along with milk for 3 months was found to increase sperm concentration, sperm motility, the level of LH, alanine aminotransferase (ALT), aspartate aminotransferase (AST), lactate dehydrogenase (LDH), isocitrate dehydrogenase (IDH), testosterone and decrease FSH and PRL levels (Gupta et al. 2013). Jasuja et al. (2013) had done a study on the extract of roots and leaves and roots of ashwagandha on male albino rats at 100 mg/kg/PO/day for 15–30 days. It shows an increase in FSH, testosterone, LH, and glutathione. This study also recovered sperm count and morphology as well (Jasuja et al. 2013).

Yadav (2014) have shown the impacts of ashwagandha extract on sexually sluggish and stressed male rats. It improves sexual function, increases erection, quantity, intromission, and ejaculation frequencies, as well as positive effects on hormone and neurotransmitter levels associated with the reduction of stress and sexual desire. Serum levels of testosterone, FSH, and LH also showed dose-related increases (Yadav 2014). A randomized, double-blind, placebo-controlled study was conducted by Wankhede et al. (2015) on healthy males between the ages of 18 and 50. A substantial rise in blood testosterone levels was observed in the study, which used 300 mg of aqueous ashwagandha root extract twice a day (Wankhede et al. 2015).

Sahin et al. (2016) had done a study on ashwagandha extract to establish the effect of the herb on testosterone production. Ashwagandha extract increased testosterone production by activating the Nrf2/HO-1 pathway and NF-κB levels were inhibited. The testicular, epididymal, vas deferens and ventral prostate weights were unaffected. It also elevated sperm count and motility, mounting and insertion frequency and serum testosterone. It has no effects on sperm morphology and testicular histopathology (Sahin et al. 2016).

Morphine-addicted male rats treated with ashwagandha root powder mixed with pelleted food, in the dose of 300 mg/kg/day for 21 days showed a restoration in serum testosterone, estrogen and LH levels to normal as morphine addiction reduces the testosterone level in the rats (Rahmati et al. 2016). Sixty stressed subjects were included in a randomized double-blinded placebo-controlled study in which they received 240 mg of ashwagandha extract daily for 15 days in capsule form with 35% withanolide glycosides, which reduce cortisol, anxiety, and dihydrotestosterone sulphate. It also helps in increased testosterone levels (Lopresti et al. 2019). In a different study, 24 healthy kathiawari horses, aged between 5 and 10 years, of either sex have shown a reduction in cortisol and epinephrine levels following doses of 2.5, 5, and 10 mg/animal for 21 days. It also shows an increase in serotonin (Priyanka et al. 2020). A study on 18 sexually mature 6-week-old male Japanese quail found that 100 mg/day/kg of ashwagandha root extract for 45 days improved the expression of estrogen receptor α resulting in an increase in estrogen and a decrease in corticosterone (Baghel and Srivastava 2021). Chauhan et al. performed a randomized controlled trial on 50 male volunteers who had lower sexual desire and administered 300 mg of ashwagandha capsule comprising the root extract of ashwagandha twice a day for 8 weeks. The extract showed a significant increase in serum testosterone levels (Chauhan et al. 2022). A dose of 300 mg twice a day for 8 weeks significantly increased the volume of semen, sperm count, concentration, and morphology in 100 healthy males aged 30–50 years, as per a prospective randomized double-blinded placebo-controlled study (Mutha et al. 2023).

4.2.2 | Fertility Enhancement

Ashwagandha generally well known for its potency as a male fertility product is primarily recognized because it enhances sperm quality, maintains the normal functioning of reproductive organs in good health, and resolves stress-induced reproductive problems. Recent clinical studies have shown the wide-ranging effects mediated through antioxidant, anti-inflammatory, and adaptogenic mechanisms.

In the same context, a study done by Mahdi et al. (2011) on ashwagandha root powder showed a 12.66% improvement in erectile dysfunction (Mahdi et al. 2011). Alcoholic root extract of ashwagandha at a dose of 500 mg/kg/PO/day helps in significantly increasing testes weight and caudal sperm count (Rajashree et al. 2011). A controlled perspective study on infertile males using ashwagandha root powder 5 g/day with milk for 3 months shows a significant decrease in sperm apoptosis in normozoospermia and oligozoospermic males and also a decrease in ROS of spermatozoa in oligozoospermic and asthenozoospermic. It also helps in increasing the concentration of metal ions (Cu^{2+}, Zn^{2+}, Fe^{2+}, and Au^{2+}) in seminal plasma (Shukla et al. 2011). Ashwagandha also shows a significant increase in testosterone and a decrease in malondialdehyde after administering 1000 mg/kg/day aqueous extract of ashwagandha root (Kumar et al. 2012). An in vivo study on fresh leaves using male albino mice shows a significant increase in the number of sperm and the regain of degenerative changes in the histological structure of both testis and epididymis. It also helps in lowering total and mitochondrial lipid peroxidation (Patil et al. 2012).

An in vivo study on healthy adult male Wistar rats at a dose of 200 mg/PO/day has shown a significant reduction in abnormalities in alcohol-induced sperm shape and sperm count. The study also reveals that the ethanolic root extract of ashwagandha helps to increase GSH and malondialdehyde levels (Bhargavan et al. 2015). The ethanolic extract of ashwagandha helps to increase the gonadosomatic index and the percentage of fertilization (96.45). It also shows a significant response to increase the percentage of sperm motility (94.18) and the percentage of active sperm cells (92.27) (Dhas et al. 2015).

Extracts from ashwagandha resulted in a remarkable degree of oxidative damage in semen samples from male rats experiencing reproductive difficulties. This positive outcome showed improvement in sperm motility and sperm count. Ashwagandha extract, after treatment incubation with the extract, showed lipid peroxidation reduction by 25% and significant ameliorative effects. This boosted mitochondrial membrane potential, a critical component for motility, in the sperm samples. This level of ROS decreased coupled with significant improvement in motility and morphology (Kumar, Ali, et al. 2015). Glycowithanolides extract of fresh leaves shows a significant increase in epididymal sperm count and weight of testes in adult Swiss albino male mice (Shaikh et al. 2015). The ashwagandha treatment exhibited improvement in sperm count (+12.5%), progressive motility (+21.42%), and improved sperm morphology (25.56%) in married male patients who were suffering from infertility, aged 18–45 years (Azgomi, Zomorrodi, et al. 2018; Azgomi, Nazemiyeh, et al. 2018). The data for the further studies have shown in Tables 3 and 4.

4.3 | Effects on Female Reproductive Health

Ashwagandha has been reported to possess potential benefits for female reproductive health mainly through the modulation of hormones, stress alleviation, and ovarian improvement. Recent studies on ashwagandha have increasingly been based on its impact on female fertility, hormonal balance, and conditions such as polycystic ovary syndrome and stress-induced menstrual irregularities.

Ashwagandha promises to modulate female reproductive hormones and hence acts therapeutically on several widespread disorders like PCOS, menstrual irregularities, and age-related decline in its function (Joshi et al. 2023; Wiciński et al. 2023). The reduction in cortisol levels, the ability to regulate gonadotropins and enhancing steroidogenesis are some of its basic mechanisms of therapeutic intervention. It can be identified as a future treatment option for those women with fertility issues and other gynaecological disorders related to polycystic ovary syndrome (PCOS) (Dhankani et al. 2023) and endometriosis (Gopal et al. 2021). A large quantity of research has been published in the last few years regarding its adaptogenic, (Oyedokun et al. 2024), anti-inflammatory (Gómez Afonso et al. 2023), and hormone-modulating activities that positively influence ovarian function. In this section I will discuss the different studies that describe its effects on female reproductive health.

Gopal et al. 2021, evaluated the efficacy and safety of KSM-66, a standardized extract of ashwagandha root (containing $> 5\%$ withanolides), for alleviating climacteric symptoms in perimenopausal females. The randomized, double-blind, placebo-controlled, study included 100 females (45–60 years old) and it was given at a dose of 300 mg (twice a day) for 8 weeks. Ashwagandha supplementation was shown to yield a statistically significant overall decrease in the total menopause rating scale (MRS) score as well as statistically significant decreases in the psychological, somato-vegetative and urogenital sub-scales, as well as a statistically significant decrease in total menopause-specific quality of life (MENQoL) scores vs. placebo. A statistically significant decrease in total MRS scores ($p < 0.0001$) was demonstrated with improved MENQoL scores ($p < 0.0001$) and decreases in both psychological, somato-vegetative and urogenital symptoms. Additionally, there was a statistically significant increase in serum oestradiol ($p < 0.0001$) and a statistically significant decrease in serum follicle-stimulating hormone ($p < 0.0001$), indicating the mechanism of action is likely hormonal modulation. Ninety-one participants completed this trial and the extract was well tolerated with no adverse (significant) events being reported. According to the authors, ashwagandha root extract can be administered safely and efficaciously as a treatment to minimize mild to moderate climacteric symptoms of perimenopause in females (Gopal et al. 2021).

Smith et al. (2023) examined publication in their ambitious study on the effectiveness and safety of Witholytin, a standardized hydroalcoholic extract of ashwagandha root at 1.5% Withanolides with a population that was afflicted with extreme stress and fatigue. In this 12-week study, 120 overweight or mildly obese men and women aged 40–75 years received 200 mg two retreats to upwards of 50 weeks. The ashwagandha group elicited a statistically significant increase in heart rate variability ($p = 0.003$) and exhibited a statistically significant decrease in fatigue relative to placebo ($p = 0.016$). Luteinizing hormone and free testosterone levels in men increased significantly ($p = 0.002$ and $p = 0.048$, respectively). The authors suggest that modulation of the autonomic nervous system and hormones could be part of the mechanism of action of the supplement. There were 55 participants in the ashwagandha group and 56 participants in the placebo group. The study found that there were no significant adverse effects and the study confirmed the safety of Witholytin for the chosen dose, over 12 weeks, and with no change in liver and kidney function (Smith et al. 2023).

Ajgaonkar et al. (2022) conducted a study to assess the safety and efficacy of ashwagandha root standardized extract on sexual health in healthy female patients having hypoactive sexual desire disorder. The clinical trial utilized randomly assigned 80 healthy females between 18 and 50 years of age to be either given 300 mg of the ashwagandha extract twice daily or a placebo at the same dose for 8 weeks. The mechanism by which it has been hypothesized to act is through the adaptogenic effect of ashwagandha, hypothesized to be stress-reducing and thus overall vitality enhancing, with its capacity to optimize sexual function. Results showed sexual function scores—specifically measured by way of the female Sexual Function Index (FSFI)—had a statistically significant increase, with the ashwagandha group having an increase in mean score from 14.20 to 22.62, compared to a lesser significant increase in the placebo group, thereby proving efficacy in the state of sexual dysfunction in the population in question (Ajgaonkar et al. 2022).

Prenatal organogenesis-stage developmental toxicity of ashwagandha root extract was evaluated in Wistar rats by Prabu

TABLE 3 | Pre-clinical studies of ashwagandha on male reproductive health.

Sl No.	Types of formulation	Effective doses	Duration of study	Disorder treated	No. of anima/volunteer is used	Type of pharmacological model/method used	Mechanism of action	References
1.	Root powder	Powder mixed with pelleted food, 6.25% w/w	4 weeks	Male infertility due to diabetic	39	Diabetic induced adult male wistar rats	Increase in progesteron, testosterone, LH, and testosterone levels, decrease in FSH levels.	Kiasalari et al. (2009)
2.	Root powder	Root Powder mixed with basal diet, 6.25% w/w	4 weeks	Male infertility due to diabetic	40	Alloxan induced diabetic adult male albino rats	Increase in progesterone in both type rats, it also increased testosterone level and LH in non-diabetic rats. Decrease in FSH.	Belal et al. (2012)
3.	Methanolic extract of leaves and roots of ashwagandha	100 mg/kg/PO/day	15–30 days	Male infertility	36	Acephate administered male albino rat	Increased Testosterone, CAT, FSH, LH, Glutathione.	Jasuja et al. (2013)
4.	Purified root powder	150 mg/kg/day and 300 mg/kg/day	30 days	—	20	Stressed and sexually sluggish male rats	Increase in LH, FSH and testosterone in serum level.	Yadav (2014)
5.	Root extract	300 mg/kg/day	8 weeks	Sexual Function	35	Sprague–Dawley male rats	Increase the level of testosterone production and also elevate sperm count and motility, mounting and insertion frequence.	Sahin et al. (2016)
6.	Root Powder	300 mg/kg/day	21 days	Morphine addicted male infertility	48	Morphine-addicted male National Maritime Research Institute (NMRI) rats	Restore the testosterone, estrogen and LH levels to normal.	Rahmati et al. (2016)
7.	Root extract	2.5, 5, 10 mg/animal	21 days	Stress induce infertility	24	Kathiawari horses of either sex	Increased the testosterone and serotonin levels and decrease the cortisol and epinephrine.	Priyanka et al. (2020)
8.	Methanolic Root extract	100 mg/day/kg	45 days	Infertility	18	Mature 6 weeks old male Japanese quail	Increase the estrogen and decreased the corticosterone.	Baghel and Srivastava (2021)

(Continues)

TABLE 3 | (Continued)

Sl No.	Types of formulation	Effective doses	Duration of study	Disorder treated	No. of anima/ volunteer is used	Type of pharmacological model/ method used	Mechanism of action	References
9.	Alcoholic root extract	500 mg/kg/day	30 days	Diabetes induced infertility	24	Male albino rat	Increase testes weight and caudal sperm count and it also increases weight of caudal epididymis in ashwagandha treated diabetics compared to insulin treated group.	Rajashree et al. (2011)
10.	Aqueous Extract of Root	1000 mg/kg/day	8 weeks	Endosulfan induced spermatozoa	10	Mice	Increased the level of testosterone and decreased the malondialdehyde and calcium, restoration of spermatozoa structure.	Kumar et al. (2012)
11.	Ethanolic extract of fresh leaves	2% extract	15 days	Chronic stress infertility	12	Male albino mice	Reduced the total mitochondrial lipid peroxidation and increased the sperm count and recover the histological structure changes in both epididymis and testis.	Patil et al. (2012)
12.	Ethanolic root extract	200 mg/PO/day	28 days	Impaired mitochondrial function	6	Male wistar rats	Increased the GSH and malondialdehyde levels.	Bhargavan et al. (2015)
13.	Ethanolic extracts	120–200–300 mg/kg WS thrice in a day	—	Infertility	—	Female and male fish (*Etroplus suratensis*)	Increased gonadosomatic index and percentage of fertilization and the percentage of sperm motility and percentage of active sperm cells.	Dhas et al. (2015)
14.	Chloroform extract of leaves	20 mg/kg	30 days	Oxidative stress-induced infertility	30	Charles foster rats	Decreased lipid peroxidation and LH, decreased sperm count and motility and testosterone.	Kumar, Ali, et al. (2015)
15.	Ethanolic root extract	300 mg/kg/day	20 days	Diabetes-induced infertility	32	Adult Swiss albino male mice	Increased epididymal sperm count and weight of testes.	Shaikh et al. (2015)

TABLE 4 | Clinical studies of ashwagandha on male reproductive health.

Sl No.	Types of formulation	Effective doses	Disorder treated	Effect on subjects	Population studied	No. of subjects	References
1.	Powdered root	5 g/day	Idiopathic infertility	Increased serum testosterone and LH and reduced the levels of FSH.	Infertile male	150	Ahmad et al. (2010)
2.	Root Powder	5 g/day/PO/ single dose	Stress-induced infertility	Decreased stress and improved the oxidation condition and overall semen quality.	Male with stress infertility Normozoospermic fertile Male	120	Mahdi et al. (2011)
3.	Full-spectrum root extract	675 mg/day	Oligospermic (sperm count less than 20 million/mL semen)	Increased sperm count (167%), semen volume (53%), and sperm motility (57%).	Oligospermic male	46	Ambiye et al. (2013)
4.	Root powder	5 g/day	Idiopathic infertility	Increased sperm concertation, sperm motility, level of LH, alanine aminotransferase, aspartate aminotransferase lactate dehydrogenase, isocitrate dehydrogenase testosterone and decrease FSH and PRL level.	Infertile male	180	Gupta et al. (2013)
5.	Aqueous powdered root extract	300 mg twice daily	Hormonal imbalance	Increased serum testosterone level	Healthy males	57	Wankhede et al. (2015)
6.	Hydroalcoholic extract (70:30)	240 mg/day	Stress-induced infertility	Decreased cortisol (−30%), anxiety, dihydrotestosterone sulphate and increased testosterone level.	Male with stress infertility	60	Lopresti et al. (2019)
7.	Aqueous root extract	300 mg twice daily	Hormonal imbalance	Increased testosterone and improved sexual functions.	Low sexual desire males	50	Chauhan et al. (2022)
8.	Root extract	300 mg twice daily	Erectile dysfunction	Increased sperm numbers and sperm concentration.	Healthy male	100	Mutha et al. (2023)
9.	Roots of ashwagandha	500 mg thrice a day	Erectile dysfunction	Increased erectile dysfunction severity index, internal mental health, quality of erection and quality of life scale.	Male with erectile disorder psychogenic type	86	Mamidi and Thakar (2011)

(Continues)

TABLE 4 | (Continued)

Sl No.	Types of formulation	Effective doses	Disorder treated	Effect on subjects	Population studied	No. of subjects	References
10.	Alcoholic root extract	5 g/day	ROS-induced infertility	Increased sperms apoptosis and decrease ROS and also increased metal ions concetration of seminal plasma.	Infertile male	75	Shukla et al. (2011)
11.	Hydroalcoholic root extract (3:1)	5 g/day	Idiopathic infertility	Increased sperm count (12.5%), sperm morphology (25.56%) and progressive motility (21.42%).	Idiopathic male infertility	100	Azgomi, Zomorrodi, et al. (2018), Azgomi, Nazemiyeh, et al. (2018)

and Panchapakesan (2015). The extract was orally administered at doses of 500, 1000, and 2000 mg/kg/day during the critical phase of organogenesis from days 5 to 19 of gestation. Its mechanism of action would be due to the adaptogenic action of ashwagandha leading to normalization of body functions and enhancement of health. The experiment employed 100 females, and none of the groups revealed any maternal or fetal toxicity. The results indicate a no-observed-effect level of the extract at 2000 mg/kg/day, indicating a safety concern in its usage specifically under the aforementioned regimen in pregnancy (Prabu and Panchapakesan 2015).

Dongre et al. (2015) conducted a pilot study to assess the safety and efficacy of high-concentration ashwagandha root extract (HCARE) on female sexual function, Fifty healthy females between the ages of 21–50 with diagnosed sexual dysfunction were randomly assigned to one of two groups: one group was given HCARE (300 mg twice daily) and the other group was given a placebo for 8 weeks. This study used psychometric instruments the FSFI and the Female Sexual Distress Scale (FSDS) from which to obtain a measurement of sexual distress and sexual function respectively. The results demonstrate that women taking HCARE experienced greater improvement than the placebo group in many areas of sexual function such as arousal, lubrication, orgasm, satisfaction, and sexual activity, and the statistical difference was noted ($p < 0.001$ for most measures). The results suggest a beneficial effect of HCARE on sexual function for women with dysfunction and perhaps an indication for treatment (Dongre et al. 2015).

This current research, by Dhas et al. (2015), investigates the effects of ashwagandha (along with other herbal extracts) on the female reproductive system, specifically the reproductive efficiency of *Etroplus suratensis*. The authors formulated four different dietary treatments (i.e., herbal maturation diets with different amounts of *Mucuna pruriens*, *W. somnifera*, and *Moringa oleifera*) and a control treatment (no herbal extracts). The experimental model was the group of brood fish under controlled conditions with chronologically systematic observation of parameters related to reproductive health and success (e.g., Gonado Somatic Index (GSI), fecundity, fertilization rates, and hatching rates). The results showed dietary herbs strongly influenced the reproductive performance of *Etroplus suratensis*, with the diet containing the most *W. somnifera* leading to significantly higher performance, providing a GSI of 3.14, a fecundity of 1325 eggs, and very high fertilization (96.45%) and hatching (91.89%) rates. Furthermore, the treatment group decreased deformed larvae to an incidence of 4.36%. This evidence supports the existing literature that herbal supplementation of brood fish has positive benefits related to female reproductive health and success (Dhas et al. 2015).

Kumar et al. (2012) investigated the action of ashwagandha and turmeric on the female reproductive system, that is, their bio-remedial efficacy in reinstating effects of the systemic toxicity caused by chlorpyrifos on the ovaries of Swiss albino mice. The experimental protocol counted on oral administration of chlorpyrifos (6 mg/kg body weight per day) for 8 weeks, followed by treatment with alcoholic extracts of ashwagandha or turmeric (50 mg/kg body weight) for another 8 weeks after the cessation of chlorpyrifos exposure. The observations indicated that chlorpyrifos exposure resulted in elevated levels of estrogen and cholesterol and severe degeneration of the ovarian components, that is, germinal epithelium and Graafian follicles. However, ashwagandha treatment resulted in a restoration of both estrogen and cholesterol levels much more than turmeric treatment and both treatments resulted in the reconstitution of ovarian histology. Specifically, ashwagandha appears to have been more effective than turmeric in the restoration of the belly of the germinal epithelium and of Graafian follicles in general. Taken together, the results indicate that under pesticide-induced stress, ashwagandha is more effective on the female reproductive system than turmeric and has a good potential to be used as a potential therapeutic in sex/gender-related disorders that reproductive health is adversely affected through exposure to environmental toxins (Kumar, Dey, et al. 2015; Kumar, Ali, et al. 2015; Kumar, Kumar, et al. 2015).

The experiment conducted by Saritha et al. (2011) studied the effectiveness of ashwagandha against the toxic effects of perinatal lead (Pb) exposure on reproduction in a female rat model. In this experiment, pregnant rats were allowed to drink water contaminated with Pb. Then, when the female pups were weaned, they were exposed to a normal diet (control) or a diet enriched with ashwagandha leaf powder (treatment). The study measured oestrous cycle length, implantation number, pre- and post-implantation loss percentages, and viable offspring number. In the experiment, Pb exposure led to longer oestrous cycle lengths, fewer implantations and viable offspring, and an increased percentage of pre- and post- implantation losses; and these toxic effects were partially mitigated (reduced) following treatment with ashwagandha, suggesting ashwagandha may counteract Pb poisoning on reproduction in females (Saritha et al. 2011).

The research of Saiyed et al. (2016) aimed to investigate the effects of hydroalcoholic extract of *W. somnifera* (WS) and *Tribulus terrestris* (TT) on letrozole-induced polycystic ovarian syndrome (PCOS) in female rats. There were 24 Wistar female rats in total, which were assigned to four groups: a negative control (no PCOS), a positive control (letrozole-induced PCOS), a test group (with hydroalcoholic extract of WS and TT), and a standard group (Clomiphene citrate as a comparator). The oestrous cycle was determined by vaginal smear. The combination of WS and TT corrected the oestrous cycle, positively affected hormonal balance (FSH, LH, oestradiol, and testosterone levels), decreased serum total cholesterol levels, decreased ovarian weight, normalized uterine weight and normalized ovarian histopathology. The authors concluded that WS and TT were effective in treating letrozole-induced PCOS in rats, which supported their traditional applications in PCOS and related conditions (Saiyed et al. 2016).

Bhattarai et al. (2010) described the effects of a methanol extract of *W. somnifera* on gonadotropin-releasing hormone (GnRH) neurons from juvenile mice, the key control mechanism of puberty and fertility. Using the whole-cell patch clamp technique, they showed that mWS depolarized the GnRH neurons which resulted in inward currents. These inward currents persisted in the presence of tetrodotoxin, a sodium channel blocker, suggesting the inward currents were due to a direct action on the membrane and did not involve action potentials. Further studies showed that the inward currents produced by mWS were blocked by bicuculline methiodide (BMI), and GABAA antagonists, showing mWS was modifying neuronal firing through GABAA receptor activation. Consequently, the study showed that ashwagandha has a bioactive component that possesses GABA mimetic activity through a direct action on GnRH neurons and possibly other aspects of reproduction as well. The present study provides further evidence of the GnRH neuron membrane effects of mWS via GABAA cell membrane receptors (Bhattarai et al. 2010).

Mutha, Mutha, Tejuja, and Langade (2025) performed a double-blind, randomized, placebo-controlled trial over 8 weeks testing the effectiveness and the safety of ashwagandha root extract (ARE) in subjects ($n = 62$) that were 18–50 years old and had female sexual dysfunction (FSD). Participants ($n = 31$) were given either the placebo ($n = 31$) or the 600 mg/day dose of ARE for 8 weeks. Outcome measures were FSFI, Female Sexual Distress Scale (FSDS), Satisfying Sexual Encounters (SSEs), Perceived Stress Scale (PSS-10), and SF-12 Quality of Life (QoL) scale. Serum hormone levels along with liver and kidney function were assessed. Results showed that ARE statistically improved FSFI scores ($p = 0.002$), notably sexual desire ($p = 0.003$) and satisfaction ($p = 0.027$), and PSS ($p = 0.0009$) and SF-12 ($p = 0.044$) compared to the placebo group. Additionally, the sexual desire level of the ARE group was statistically ($p < 0.0001$) higher than the placebo group throughout the study. The extract was well-tolerated; no safety parameters or hormone levels were significantly different at the end of the trial. Authors concluded that ARE may be clinically relevant in the treatment of sexual dysfunction and improving quality of life in females with sexual dysfunction and is a potential treatment of FSD (Mutha, Mutha, Tejuja, and Langade 2025).

Steels et al. (2018) conducted a clinical trial with 117 participants ages 40–65 years old to examine the effectiveness and safety of ashwagandha for symptom management of menopause in women with no control. After screening, the sample was randomized into two groups. Investigators administered either the 100 mg ashwagandha dose or matched placebo in capsule form twice a day for 12 weeks. The final outcome of the trial, frequency of menopausal symptoms, was measured using the MENQOL questionnaire. Participants in the active treatment group showed a statistically significant improvement on the total MENQOL and the domains from the MENQOL questionnaire compared with the participants in the placebo group after the study period of 12 weeks regardless of what type of menopause they had (natural or surgically induced). Participants in the active treatment group also experienced a decrease in hot flushes overall, especially daytime and night sweats compared to participants in the placebo group. The trial concluded finally that the combination of *Tinospora cordifolia*, *Asparagus racemosus*, *W. somnifera*, and *Commiphora mukul* is an effective and safe therapeutic course to treat the symptoms of menopause in healthy menopausal females for 12 weeks (Steels et al. 2018). The data for further studies have been shown in Tables 5 and 6.

5 | Conclusion

These pieces of evidence from different research groups conclude that ashwagandha can enhance the quality of semen, support

TABLE 5 | Pre-clinical studies of ashwagandha on female reproductive health.

Sl No.	Types of formulation	Doses	Duration of study	Condition treated/ improved	No. of animals used	Disorders associated with subjects	Type of subjects used	Effect on model	References
1.	Root extract	500, 1000, and 2000 mg/kg/day	From days 5 to 19 of gestation		100	Prenatal developmental toxicity	Female wistar rats	The adaptogenic action of Ashwagandha leading to normalization of body functions and enhancement of health	Prabu and Panchapakesan (2015)
2.	Ashwagandha extract	Extract blended diet	—		—	—	Fish species *Etroplus suratensis*	Diet containing maximum Ashwagandha enhanced Gonado Somatic Index, fertilization and hatching rates. Also this diet reduced the incidence of deformed larvae.	Dhas et al. (2015)
3.	Alcoholic extracts of ashwagandha	50 mg/kg	8 weeks		—	Toxicity by chlorpyrifos	Swiss albino mice with chlorpyrifos-induced toxicity to the ovaries.	Induce a restoration of estrogen and cholesterol level reconstitution of ovarian histology.	Kumar, Dey, et al. (2015), Kumar, Ali, et al. (2015), and Kumar, Kumar, et al. (2015)
4.	Leaf powder	Leaf powder-enriched diet	—		—	Reproductive system suppressed by lead	Female rats with perinatal lead (Pb) exposure toxicity	Ashwagandha rich diet restored the reproctive health and extended the estrus cycle in the subjects.	Saritha et al. (2011)
5.	Hydroalcoholic extract	198 mg/kg (Combination of Ashwagandha and gokharu)	6 days		24	Letrozole induced PCOS	Female wistar rat with letrozole-induced PCOS	Corrected estrous cycle, improved hormonal equilibrium, lowered serum cholesterol, decreased ovarian weight, normalized uterine weight, and normalized ovarian histopathology	Saiyed et al. (2016)
6.	Methanolic extract	400 ng/μL	—		—	—	Juvenile mice	Restore the testosterone, estrogen and LH levels to normal	Bhattarai et al. (2010)

TABLE 6 | Clinical studies of ashwagandha on female reproductive health.

Sl No.	Types of formulation	Effective doses	Population studied	No. of subjects	Disorders associated with subjects	Effect on subjects	References
1	Root extract	300 mg twice a day	Premenopausal female	100	Climacteric symptoms and hormonal imbalance in premenopausal female	Increased serum estradiol and decreased the serum concentration of FSH.	Gopal et al. (2021)
2	Root extract	200 mg twice a day	Healthy female and male aged 40–75 years.	120	Stress and fatigue induced infertility	Increased serum estradiol concentration in premenopausal female and reduced the same in post-menopausal female.	Smith et al. (2023)
3	Root standardized extract	300 mg twice a day	Healthy female aged 18–50 years	80	Hypoactive sexual desire disorder in healthy female	Ashwagandha reduced stress and improve overall vitality.	Ajgaonkar et al. (2022)
4	Root extract	300 mg twice a day	Healthy female between the ages of 21 and 50	50	—	Improvements in the various components of sexual function, including arousal, lubrication, orgasm, satisfaction, and overall sexual activity	Dongre et al. (2015)
5	Root extract	600 mg/day	Female of age group 18–50 years	62	Sexual dysfunction	Improved significantly the Female Sexual Function Index score, mainly sexual desire, satisfaction and Perceived Stress Scale	Mutha, Mutha, Tejuja, Beldar, et al. (2025)
6	Full spectrum root extract	300 mg twice a day	Healthy female experiencing sexual dysfunction	50	Sexual dysfunction	Significant improvements in desire, arousal, lubrication, orgasm, satisfaction, pain, and overall Female Sexual Function Index scores	Dongre et al.
7	—	100 mg twice a day	Female aged between 40 and 65 years	117	Menopausal symptoms	Lower the overall number of hot flushes, day hot flushes, and night sweats	Steels et al. (2018)

reproductive hormones and menstrual health, thereby supporting overall fertility and sexual well-being of both males and females. Its antioxidant effects also have protective advantages against oxidative stress, which is often held responsible for reproductive disease. While ashwagandha is promising as a natural treatment for certain reproductive issues, more clinical trials are needed to determine its efficacy, optimal dosage, and long-term safety profile. Nevertheless, the incorporation of ashwagandha into reproductive health programs could be a useful complementary therapy choice, which would allow for the adoption of an integrated approach to sexual health and fertility improvement.

For future research, based on the findings from this systematic review, priority should be given to conducting large sample size long-term randomized controlled trials (RCTs) on standardized, marketed ashwagandha extracts to support the identification of optimal dosing regimens specific to gender and to assist in confirming the efficacy of the herb over a sustained period of time. Mechanistic research also needs to clarify the interactions of ashwagandha on the neuroendocrine systems (i.e., HPG/HPA axes) as well as its action on cell-based targets (i.e., steroidogenic enzymes, antioxidant genes) in males and females. Safety studies should be conducted in vulnerable populations, such as, pregnant females, adolescents, and people with endocrine disorders. In addition to those populations, research should also evaluate the interactions of ashwagandha with conventional therapies (i.e., for PCOS or infertility) and validated biomarkers (i.e., markers of oxidative stress, hormone profiles) to provide personalized treatment. Lastly, the use of discovery-based multi-omics approaches may allow investigations into new bioactive compounds and determine their synergistic effects in best promoting reproductive health.

Author Contributions

Debajyoti Roy: methodology, writing – original draft, writing – review and editing. **Maitrayee Ghosh:** methodology, writing – review and editing. **Dipan Roy:** drawing-figures. **Nitin Sharma:** methodology, supervision. **Naresh Kumar Rangra:** methodology, conceptualization, supervision. **Rohit Bhatia:** supervision.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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