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REVIEW

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Therapeutic potential of Shatavari: a nutraceutical for women's health

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ABSTRACT

Shatavari (*Asparagus racemosus*) is a medicinal herb central to Ayurveda, known for promoting women's health through hormonal regulation and reproductive support. Its bioactive compounds, such as steroidal saponins, act as phytoestrogens, helping maintain hormonal balance. Increasingly recognized in natural supplementation, it offers therapeutic potential for conditions related to hormonal health. It is traditionally used to address premenstrual syndrome (PMS), polycystic ovary syndrome (PCOS), and menopausal symptoms. Its adaptogenic properties help manage stress, further supporting hormonal stability. However, broader clinical validation is required to confirm its benefits and establish dosage guidelines. This review synthesized findings on its hormonal effects, reproductive benefits, and stress-modulating properties. Various formulations like capsules, powders, and tinctures were evaluated for their therapeutic outcomes. Research shows it regulates menstrual cycles, alleviates menopausal symptoms, improves fertility, and enhances lactation. Its antioxidant properties also mitigate oxidative stress, supporting reproductive health. However, most findings come from small-scale studies, requiring further research. Variability in formulations and limited clinical trials complicate therapeutic standardization. Pharmacokinetic studies are essential to understand absorption, metabolism, and potential drug interactions. This review aims to bridge traditional knowledge and modern research, highlighting Shatavari's potential as a nutraceutical and emphasizing the need for further clinical studies for safe integration into healthcare.

KEYWORDS

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Introduction

Shatavari (*Asparagus racemosus*) holds a significant place in Ayurveda, the ancient Indian system of medicine that focuses on the interdependence of bodily systems and individual constitution to maintain health and balance. Recognized as the "queen of herbs," shatavari has been traditionally used to promote women's health by supporting reproductive wellness, emotional well-being, and hormonal regulation. Its adaptogenic properties aid the body in coping with physiological and psychological stress, contributing to its wide use in addressing female reproductive concerns [1].

It has been employed in Ayurveda to manage various aspects of women's health, including menstrual regulation, alleviation of menopausal symptoms, and enhancement of lactation. The herb's bioactive components, particularly steroidal saponins, exhibit estrogenic effects that support hormonal equilibrium. Additionally, it serves as a galactagogue, improving milk production during lactation. Its adaptogenic and antioxidant properties contribute to reducing oxidative stress, which is often implicated in conditions like PCOS and PMS. Moreover, the herb has demonstrated potential in modulating reproductive hormones, enhancing fertility, and providing symptomatic relief in menopausal women [2].

Although recent studies have explored the therapeutic effects of shatavari, most research remains confined to animal models or preliminary clinical trials. For example, estrogen-modulating properties have been demonstrated in rodent studies, but human clinical trials have yet to confirm these findings consistently [3]. The variability in preparation methods, dosing, and bioavailability of shatavari products presents additional challenges in establishing standardized treatment protocols. Moreover, the pharmacokinetics specifically, the absorption, metabolism, and elimination of the herb remain poorly understood. These limitations emphasize the need for larger, well-designed clinical trials to validate its efficacy and ensure therapeutic consistency [4].

Despite promising preliminary results, several knowledge gaps persist. There is a critical need for randomized controlled trials involving diverse populations to determine its effectiveness in conditions such as PCOS, PMS, and menopausal symptoms. Furthermore, the herb's pharmacokinetic profile requires clarification to optimize dosing strategies and ensure patient safety. Long-term safety studies are essential, particularly in individuals taking concurrent medications, to evaluate potential interactions and adverse effects. Addressing these gaps will facilitate the integration of shatavari into evidence-based practice in women's healthcare [5].

The objective of this review is to integrate traditional Ayurvedic knowledge with contemporary scientific research to assess the therapeutic potential of shatavari in women's health. This review will focus on the herb's role in reproductive health, hormonal regulation, and management of conditions such as PMS, PCOS, and menopause. By highlighting both traditional uses and modern scientific evidence, this review

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aims to offer a comprehensive understanding of its relevance as a nutraceutical and identify directions for future research to enhance clinical practice.

Phytochemistry of Shatavari

Active compounds

Shatavari contains a rich variety of bioactive compounds responsible for its therapeutic effects. Steroidal saponins, including Shatavarin I-IV, are the primary active ingredients. Shatavarin I, with glucose and rhamnose moieties, enhances solubility and receptor interaction, contributing to the herb's estrogen-modulating properties. Shatavarin IV, in particular, is known to improve estrogen receptor activity, making it useful for menstrual regulation and menopausal relief. Additionally, flavonoids such as quercetin, kaempferol, and rutin provide potent antioxidant effects that reduce oxidative stress, which plays a role in hormonal imbalances. Alkaloids, including asparagamine A, have been reported to possess neuroprotective properties and adaptogenic effects, promoting emotional well-being and stress management [6] (Table 1) .

Mechanism of action

The bioactive compounds exhibit several mechanisms that support reproductive and hormonal health. The steroidal saponins interact with estrogen receptors, mimicking natural estrogen's effects, which help regulate menstrual cycles, improve fertility, and alleviate menopausal symptoms. Clinical studies suggest that it may help restore hormonal equilibrium by modulating cortisol levels and stabilizing the hypothalamic-pituitary-adrenal (HPA) axis, thus enhancing the body's resistance to stress. Additionally, its antioxidant flavonoids neutralize free radicals, reduce inflammation, and improve immune function. These combined effects make it a comprehensive nutraceutical for managing reproductive disorders like PCOS and PMS [7].

Modern extraction methods

Several modern techniques are employed to extract and quantify its bioactive compounds. Soxhlet extraction is frequently used, employing a continuous hot solvent system that allows the efficient recovery of thermally stable compounds like saponins. Ultra-high-performance liquid chromatography (UHPLC) ensures precise quantification of compounds such as Shatavarin IV, aiding in standardization for nutraceutical formulations. Furthermore, supercritical CO_2 extraction offers an eco-friendly alternative, preserving bioactivity while achieving high purity and bioavailability. These advanced extraction methods help ensure consistency in therapeutic applications and enhance the herb's effectiveness in clinical settings [8].

Table 1. Categories of diseases associated with chronic stress.

Compound	Chemical Composition	Source of Extraction	Extraction Process	Application
Shatavarin I-IV	Steroidal saponins with glucose and rhamnose moieties	Roots of *Asparagus racemosus*	Soxhlet extraction with methanol	Hormonal regulation, lactation enhancement
Sarsasapogenin	Aglycone of steroidal saponins	Woody roots of *Asparagus racemosus*	Methanolic extraction and chromatography	Anti-inflammatory, adaptogenic, estrogenic effects
Quercetin	Polyphenolic flavonoid ($C_{15}H_{10}O_7$)	Leaves, flowers, and roots	Ethanolic extraction followed by filtration	Antioxidant, anti-inflammatory properties
Kaempferol	Polyphenolic flavonoid ($C_{15}H_{10}O_6$)	Roots and flowers	Methanolic extraction with HPLC quantification	Antioxidant, anti-cancer potential
Asparagamine A	Pyrrolizidine alkaloid	Roots	Aqueous extraction	Neuroprotection, adaptogenic properties
Rutin	Glycosylated flavonoid ($C_{27}H_{30}O_{16}$)	Leaves and roots	Ethanolic extraction using Soxhlet apparatus	Antioxidant, anti-inflammatory effects

Shatavari for Hormonal Balance

Regulation of estrogen and progesterone

It is known for its phytoestrogenic properties, meaning it contains plant-based compounds that mimic estrogen. These phytoestrogens help regulate estrogen and progesterone levels, promoting hormonal balance. Research suggests that this herb can support the body's endocrine system, especially during times when hormone production fluctuates, such as menstruation and menopause. Its steroidal saponins enhance progesterone activity, contributing to better ovulation and menstrual regularity [9].

Menstrual health

It is beneficial in managing menstrual disorders by alleviating symptoms of PMS and dysmenorrhea. Its anti-inflammatory and antispasmodic properties help reduce uterine cramping and bloating, offering relief from discomfort during the menstrual cycle. Additionally, it promotes the regulation of irregular cycles by restoring hormonal balance, improving the overall quality of life for women experiencing hormonal disturbances [10].

Menopause support

Menopausal symptoms such as hot flashes, mood swings, and night sweats are often linked to declining estrogen levels. It has been shown to mitigate these symptoms by acting as a natural estrogen modulator. In clinical studies, supplementation with shatavari improved emotional well-being, reduced the intensity of hot flashes, and helped manage other menopausal challenges, including insomnia and low libido. Its adaptogenic effects also support stress reduction, further enhancing emotional stability during menopause [11].

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Scientific evidence

A growing body of scientific literature supports the traditional uses of Shatavari. Clinical studies have demonstrated its effectiveness in modulating hormone levels, with improvements noted in both estrogen and progesterone balance. A study on menopausal women showed significant relief from menopausal symptoms after regular intake, with improvements observed in emotional, sexual, and occupational domains of quality of life assessments. Although most studies are small-scale, they provide promising insights into the herb's efficacy in maintaining hormonal health. Ongoing research aims to further validate these findings and establish standardized dosages for clinical use [12].

Shatavari for Reproductive Health and Fertility

Fertility support

It is widely recognized for its role in promoting fertility by supporting ovulation, balancing reproductive hormones, and maintaining the health of reproductive organs. Its active compounds, such as steroidal saponins, exert estrogen-like effects, enhancing the function of reproductive tissues and regulating the menstrual cycle [13]. Additionally, its anti-inflammatory properties help reduce oxidative stress, a known factor in ovulatory dysfunction, thereby improving fertility outcomes. Specific studies have demonstrated that regular use of shatavari enhances follicular maturation and promotes healthy ovulation, making it a valuable natural remedy for couples facing fertility challenges. Its antioxidant activity further supports egg quality, which is critical for conception, particularly in women experiencing age-related decline in fertility [14].

Pregnancy and postpartum health

It has traditionally been used during pregnancy and postpartum recovery, contributing to maternal health and well-being. As a galactagogue, it increases prolactin levels, which enhances milk production without adverse effects. Clinical studies on lactating mothers have shown significant improvements in both the quantity and quality of breast milk following supplementation, with additional benefits for maternal mood and infant well-being [15]. Its adaptogenic properties help manage common postpartum challenges, including anxiety, fatigue, and emotional fluctuations, thereby promoting smoother recovery. Furthermore, its anti-spasmodic properties protect against preterm contractions, reducing the risk of preterm labour. Rich in folic acid and other essential nutrients, it also aids foetal development, supporting healthy neural and skeletal formation throughout pregnancy [16].

Scientific research

Scientific studies have begun to validate the traditional uses of shatavari for reproductive health. Research indicates that supplementation improves hormonal regulation, leading to better reproductive outcomes in women with irregular cycles and hormonal disorders, such as PCOS. In a randomized controlled trial, postpartum women receiving shatavari showed significant improvements in lactation and maternal satisfaction compared to those given a placebo. However, most studies to date have focused on animal models, limiting the generalizability of findings to broader populations. Additional research involving larger human populations is necessary to confirm these benefits and establish standardized dosing protocols. It is also crucial to assess the long-term safety, particularly in individuals taking concurrent medications or supplements, to ensure safe integration into reproductive healthcare [17].

Shatavari as an Adaptogen and Stress Reliever

Stress and hormonal imbalance

Chronic stress activates the hypothalamic-pituitary-adrenal (HPA) axis, causing an increase in cortisol levels. Elevated cortisol disrupts the production of reproductive hormones like estrogen and progesterone, impairing ovarian function, and contributing to menstrual irregularities, infertility, and PCOS. Prolonged stress can also lead to mood disorders such as anxiety and depression, which further affect hormonal balance and reproductive health, creating a cycle of physiological and emotional distress [18].

Shatavari as an adaptogen

It functions as an adaptogen by promoting homeostasis and modulating the body's stress response. Adaptogens work by stabilizing the adrenal glands, regulating cortisol production, and enhancing the body's ability to adapt to physical and emotional stress. Its phytoestrogens mimic estrogen, supporting hormonal balance, particularly during menstruation and menopause, when hormonal fluctuations are common. Through these mechanisms, it helps alleviate stress-induced hormonal disturbances, promoting reproductive health and emotional well-being [19].

Impact on mental health

By addressing physiological stress, it also contributes to mental health. Preliminary evidence suggests that shatavari can reduce symptoms of anxiety and depression, likely through modulation of neurotransmitter pathways, though further studies are required to fully elucidate its effects. In clinical settings, it has been shown to alleviate fatigue and improve mood, which are often exacerbated by hormonal imbalances and chronic stress. This dual impact on both physical and psychological health makes it a promising intervention for women experiencing stress-related reproductive issues [5].

Scientific support

Several studies highlight shatavari's adaptogenic and stress-relieving properties. For instance, research involving women with PCOS showed that supplementation improved menstrual regularity and reduced excessive hair growth, indicating normalization of ovarian function. Another clinical trial found that it reduced cortisol levels, suggesting its potential in improving stress management by modulating the HPA axis. These findings underscore the herb's role in promoting both hormonal balance and mental resilience, offering holistic support to women [10].

Nutraceutical Potential and Formulations

Forms and dosage

It is formulated in various forms to cater to diverse health needs, including powders, capsules, tinctures, and teas. Powders are

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commonly recommended at 1–2 teaspoons daily, typically mixed with warm water or milk. Capsules, which offer convenience, are available in doses of 500 mg to 1 g, taken one to two times per day with meals. Tinctures, preferred for rapid absorption, are usually prescribed at 3–5 mL, three times daily, targeting stress and reproductive health [20]. Teas, often combined with other herbs, provide gentle support for hormonal balance and digestion, making them ideal for long-term wellness routines. However, it is essential to consult healthcare providers for personalized dosage, especially when addressing specific health conditions like menopause or PCOS [21].

Table 2. Different forms of shatavari and their dosage.

Biocompound	Forms of Usage	Dosage	Applications	Blend with Other Herbs (If Any)	Applications of Blended Herbs
Steroidal Saponins (Shatavarins)	Capsules, Powder, Liquid Extract	500-1000 mg/day (capsules), 1-2 tsp/day (powder)	Hormonal balance, Menopausal relief, PMS	Ashwagandha, Guduchi	Enhances vitality, Improves immune function
Isoflavones	Powder, Tea, Capsules	1-2 tsp/day (powder), 1-2 cups/day (tea)	Menstrual regulation, Fertility enhancement	Fenugreek, Licorice	Lactation support, Anti-inflammatory
Mucilage	Tincture, Gel	10-15 ml/day (tincture)	Cervical mucus support, Fertility promotion	Shankhpushpi	Improves cognitive function
Flavonoids (Quercetin)	Capsules, Tablets	500 mg/day (capsules)	Reduces oxidative stress, Supports ovarian health	*Ginkgo Biloba*	Boosts circulation, Improves cognitive health
Antioxidants (Racemofuran)	Extract, Powder	Varies depending on formulation	Promotes reproductive health under stress	Triphala	Detoxification, Digestive health

Synergy with other herbs

It is frequently combined with other Ayurvedic herbs to enhance its therapeutic benefits. Ashwagandha, another adaptogen, complements shatavari by increasing resilience to stress and stabilizing cortisol levels, which are crucial for hormonal balance.Similarly, Triphala, a herbal blend known for detoxifying the digestive system, can improve nutrient absorption and bioavailability, maximizing shatavari's effectiveness [22]. These synergistic combinations are used in formulations targeting reproductive health, stress management, and immune support, reflecting Ayurveda's holistic approach to health. Table 2 explains the different forms of shatavari available along with their blends with other herbs. It also mentions the dosage of each of the form.

Commercial success and global market

Shatavari has witnessed growing popularity in the global nutraceutical market, especially as interest in herbal supplements has surged in North America and Europe. Products featuring shatavari, such as capsules and teas, are marketed for their benefits in reproductive wellness, lactation support, and hormonal balance. However, with increasing demand, the importance of sustainable sourcing is paramount to prevent overexploitation of the plant. Ethically sourced shatavari products align with consumer preferences for environmentally responsible practices, ensuring the herb's continued availability in the global market [23].

Challenges and Limitations

One of the key challenges in utilizing shatavari for women's health lies in the lack of large-scale clinical trials. Although some small-scale studies have suggested its potential benefits for managing conditions like hormonal imbalances, PCOS, and menopausal symptoms, most findings are limited to animal models or preliminary human trials. Without robust randomized controlled trials involving diverse populations, the generalizability of these findings remains uncertain. This highlights the need for more comprehensive research to confirm its therapeutic efficacy and ensure its safe use across various patient demographics [24].

In addition to limited clinical data, quality control issues present another significant barrier. Variations in the preparation, purity, and bioavailability of Shatavari supplements complicate standardization efforts. Differences in regulatory oversight between countries further exacerbate these challenges, with herbal supplements often lacking consistent quality assurance standards. Ensuring therapeutic consistency requires stricter adherence to good manufacturing practices and standardized dosing guidelines in the nutraceutical industry. Despite being considered generally safe, it is not without potential side effects and contraindications. Reports of allergic reactions, including skin rashes, respiratory discomfort, and itching, have been noted, though such occurrences are rare. Special caution is needed during pregnancy, as the herb's estrogenic activity may interfere with hormonal regulation. Its use during pregnancy and breastfeeding should only be under the guidance of a healthcare provider to minimize risks [25].

Conclusions

Shatavari plays a critical role in promoting hormonal balance, reproductive wellness, and stress reduction, making it particularly beneficial for managing conditions such as premenstrual syndrome (PMS), polycystic ovary syndrome (PCOS), and menopausal symptoms. Its phytoestrogenic compounds mimic estrogen, supporting hormonal equilibrium, while its antioxidant properties help alleviate oxidative stress.

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Shatavari also acts as a galactagogue, improving lactation, and functions as a rejuvenating tonic for postpartum and menopausal women, promoting long-term well-being. Despite these promising benefits, further research is necessary to fully understand the herb's mechanisms of action and ensure consistent therapeutic outcomes. Variations in product formulations, extraction methods, and dosing guidelines currently present challenges in standardizing its clinical use. Well-designed clinical trials across larger and more diverse populations are needed to confirm the safety and efficacy of shatavari in treating hormonal and reproductive disorders. Additionally, pharmacokinetic studies are essential to determine optimal dosing strategies, absorption, and potential drug-herb interactions, ensuring patient safety. With the increasing demand for natural remedies and plant-based supplements, it holds significant potential to become a cornerstone nutraceutical for women's health. Its ability to support reproductive health and hormonal balance across various life stages from menstruation to menopause highlights its value in modern healthcare. As research advances and evidence accumulates, shatavari can further solidify its position as an essential component of women's wellness strategies.

Disclosure statement

No potential conflict of interest was reported by the author.

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