Herbal Approach to Hormonal Health: Insights into *Asparagus racemosus*, *Actaea racemosa* and *Vitex agnus-castus*

Iqra Shafeeq[1,*], Naila Hadayat[2], Ammar AL-Farga[3], Ayah Talal Zaidalkilani[4], Shahid Hussain Farooqi[5] and Jaweria Akhter[6]

[1]Department of Pharmacology and Toxicology, Faculty of Bio-Science. University of Veterinary and Animal Sciences, Lahore, Pakistan
[2]Department of Botany, Division of Science and Technology, University of Education, Lahore, Pakistan
[3]Department of Biological Sciences, College of Science, University of Jeddah, Jeddah, Saudi Arabia
[4]Faculty of Pharmacy and Medical Sciences, Department of Nutrition, University of Petra, Amman, Jordan
[5]Department of Clinical Sciences, KBCMA College of Veterinary and Animal Sciences, Narowal, Sub-campus UVAS-Lahore, Pakistan
[6]Department of Biology Sciences, Superior University, Lahore, Pakistan
*Corresponding author: iqrashafeeq8695@gmail.com

Abstract

Hormonal imbalances in women can lead to various health concerns, including menstrual irregularities, menopause-related symptoms, and reproductive issues. Herbal medicine has been increasingly explored as a natural approach to restoring hormonal balance due to its bioactive compounds that interact with the endocrine system. This review examines the therapeutic potential of key medicinal plants such as *Vitex agnus-castus* (Chaste Tree), *Asparagus racemosus* (Shatavari), and *Actaea racemosa* (Black Cohosh) in regulating hormonal fluctuations. These herbs have shown promise in alleviating symptoms of premenstrual syndrome (PMS), polycystic ovary syndrome (PCOS), and menopause by modulating estrogen, progesterone, and other hormone levels. The phytochemicals in these plants influence hormone secretion, receptor activity, and neurotransmitter functions, offering a holistic alternative to conventional hormone therapy. While herbal remedies are generally considered safe, their efficacy and potential interactions require further clinical research. Understanding the mechanisms of these botanical interventions can provide a foundation for integrating herbal medicine into women's healthcare. This review highlights the need for standardized formulations and evidence-based approaches to ensure the safe and effective use of herbal treatments for hormonal balance.

Keywords: Women's Hormonal Health, Chasteberry, Shatavari, Black cohosh, Essential oil, Phytotherapy, Alternative medicine, Holistic Health

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Introduction

Hormonal balance is crucial for women's health, as it regulates reproduction, temper, and metabolism. Hormone imbalances, such as estrogen, progesterone, and testosterone, can cause reproductive difficulties, temper problems, and metabolic disruptions. The endocrine system produces hormones that regulate physiological processes, and disruptions can have serious consequences for women's fitness. Hormonal stability is closely linked to the reproductive system. (Gildner, 2021; MacKendrick & Troxel, 2022). Hormonal imbalances, such as polycystic ovarian syndrome (PCOS) and irregular menstrual cycles, can negatively affect fertility and contribute to difficult reproductive conditions (Zehravi et al., 2022). Menopause and perimenopause are periods in a woman's life that attract a host of changes due to fluctuation in hormone levels. These changes recur every month with changes in temperature, and also the moods do change during this phase according to some accounts (Mohapatra et al., 2020; Peate et al., 2021). Enormous fluctuations in hormone levels is generally seen in menstruation cycles and also in pregnancy which in turn results in issues like pondering anger management and postnatal depression (Cao et al., 2020; Takayama et al., 2020). Therefore, when there is a noticeable imbalance in the hormone levels in women, they tend to be targeted for issues which are specific for women and can be targeting various activities in which women are engaged and also targeting physical intervention to amend their quality of life (Bailey et al., 2022). Hormonally, women have a lot going within their bodies due to the fact that estrogen levels dictate a lot of things ranging from metabolism to fat storage even the fat distribution which in turn can lead to issues like cardiovascular diseases and even make one prone to type 2 diabetes if estrogen levels are not maintained (Pylypchuk et al., 2021; Zhu et al., 2021). The need to draw inferences when considering the link between metabolic health and hormonal balance is vital as per the new prevention methods and therapies available. Looking into some of the recent studies it could be inferred that a woman who is losing feminine hormones in her body might lose bone density resulting in osteoporosis which increases the chances of fractures during menopause (Wang et al., 2023).

Role of Nature in Health

Ethno pharmacological descriptions of plant species can serve as an initial screening method to identify bioactive chemicals. As an example, the World Health Organization (WHO) estimated that around 80% of the earth's inhabitants depend on herbal principles as their major healthcare, which highlighted the significance of plants in global health care since the dawn of humanity (Ali et al., 2006; Kim et al., 2020). Plant-based medications have been used from the earliest times of humans treating both physical and mental illnesses (Yuan et al., 2016). Since then, the processes of medicine and treatment have evolved, and whereas traditional medical focused on a holistic way of life around health and its maintenance, modern medicine emphasizes unraveling the changes that bring on disease and killing it (Fries, 2019).

In contemporary treatment plans, herbal medicines have been replaced by synthetic pharmaceuticals and targeted medicinal approaches. But this deficit is a major obstacle to clinical efficacy markers. Future studies in preclinical models could identify markers such as mRNA and miRNA that can distinguish patients that are likely to benefit from herbal medicine therapy from those that likely will not (Bachmeier et al., 2007; Bachmeier et al., 2008; Bachmeier et al., 2009; Bachmeier et al., 2010; Killian et al., 2012; Kronski et al., 2014).

Two common gynecological conditions include symptoms which occur during pre- and post-menopause. The German medical guideline for post- and pre menopause specifies that vasomotor symptoms including hot flushes alongside sweating must receive hormone therapy for menopause treatment (HRT) only when contraindications are absent (Inwald et al., 2021). The reproductive health disorder known as PMS shows itself through many physical and mental symptoms which occur ahead of menstruation.

Botanical Distribution of *Asparagus racemosus* (Shatavari)

It has been used as a general tonic as well as a female reproduction tonic (Sharma & Bhatnagar, 2010). The plants grow three meters high under shrub. The spinous herb is a cluster of numerous short root succulents (Goyal et al., 2003). The roots of the plant are long, tuberous, brownish, and taper at both ends. This can reach 25–90 cm in height and 1-2 cm in thickness; the exterior or interior silver white. The woody climbing plant produces protective pine needles above its leaves which change from white to grey as it ages. The little uniform blooms blossoms appear during the months of February and March. The fragrant hermaphrodite blooms of this plant primarily undergo contamination by bees according to multiple studies (Table 1) (Kumar et al., 2008; Sachan et al., 2012; Choudhary & Sharma, 2014). The fruits with bright red barries contain small spherical obstacles that change color from green to red. The root's cross-section appears either ellipsoidal or round. Five to six layers of compact cells alongside thin-walled phellems make up the structure of the cork.

Table 1: Phytochemical constituents of *Asparagus racemosus*

Name	Compound	Reference
A. Root extract & Stem extract of tuberous		
3-O-[α-L-rhamnopyranosyl-(1→2)-α-L-rhamnopyranosyl-(1→4)-O-β-D-glucopyranosyl]-25(S)- spirosta-3β-ol (Sekine et al.)	Steroidal	(Tambvekar, 1985)
Racemoside A, B, C	Steroidal	(Handa et al., 2003)
Shatavarins	Steroidal	(Mandal et al., 2006)
Asparanin A	Steroidal	(Kumeta et al., 2013)
Immunoside	Steroidal	(Kumeta et al., 2013)
27 α-dimethyl-1β, 2β,3β-trihydroxy-25-spirost-4-en-19β-oic	Steroidal	(Hayes et al., 2008)
Sarsasapogenin	Steroidal	(Sharma et al., 2011)
Diosgenin	Steroidal	(Sharma et al., 2011)
Sitosterol	Steroidal	(Ahmad et al., 1991; Paliwal et al., 1991; Khare, 2008)
Anti-HIV compounds	Steroidal	(Bose et al., 2012)
Filiasparoside C	Steroidal	(Sabde et al., 2011)
Shatavaroside A	Steroidal	(Sharma et al., 2009)
Shatavaroside B	Steroidal	(Sharma et al., 2013)
Asparagamine A	Alkaloid	(Sekine et al., 1995)
Polycyclic alkaloid	Alkaloid	(Singla & Jaitak, 2014)
Racemosol (9, 10-dihydro-1, 5-dimethoxy-8-methyl-2, 7- phenanthrene diol)	Dihydrophenanthrene derivative	(Sekine et al., 1997)
Racemofuran	Furan derivatives	(Wiboonpun et al., 2004)
8-Methoxy-5,6,4-trihydroxyisoflavone-7-O-β-Dglucopyranoside	Flavonoid	(Saxena & Chourasia, 2001)
Cyanidine-3-galatoside	Flavonoid	(Ahmad et al., 1991)
B. Leaves		
Kaempferol	Flavonoid	(Ahmad et al., 1991)
5-hydroxy-3,6,4'-trimethoxy-7-O-β-D-glucopyranosyl-[1→4] -O-α-D-xylopyranoside	Flavonoid	(Saxena & Chourasia, 2000)
C. Flowers and fruits		
Quercetin-3-glucuronide	Flavonoid	(Bopana & Saxena, 2007)
Quercetin	Flavonoid	(Bopana & Saxena, 2007)
Rutin	Flavonoid	(Bopana & Saxena, 2007)
Hyperoside	Flavonoid	(Bopana & Saxena, 2007)

Reproductive Health Related Effect

The indicated uses of this treatment cover a range of female reproductive issues including irregular menstrual cycles, endometriosis, dysmenorrhea, uterine bleeding, amenorrhea, sexual weakness, dysfunction, menopause, and pelvic inflammatory diseases that cause sexual dysfunction. The substance used to treat PMS dates back to ancient times for uterine tonic purposes which leads to uterine prolapse while strengthening and nourishing the uterus. The substance eradicates infertility and prepares the uterine wall for contraction during fetal development to prevent miscarriages. The compound supports lactation by maintaining balanced hormone levels. The treatment enhances folliculogenesis and increases ovarian weight while its root extract boosts serum FSH levels (Yue et al., 2004; Jagannath et al., 2012; Somani et al., 2012). *A. racemosus* contains saponins that block oxytocic effects on uterine muscles which keeps uterine activity unrestricted and demonstrates its effectiveness in dysmenorrhea treatment for painful periods without pelvic disease. The shatavari formulation Shatavri sidh girit containing Shatavarin 1 makes it the recommended treatment for threatened abortion.

A team of researchers investigated the antidopaminergic activity of *A. racemosus* with the working hypothesis that the therapeutic effects of shatavari, such as galactogogue and dyspepsia, might be caused by an active principle with dopamine receptor antagonistic activity because shatavari produced effects that were comparable to those of the dopamine receptor antagonist metoclopramide. Prolactin levels increased in a manner similar to those of metoclopramide, but no antidopaminergic effect was seen (Dalvi et al., 1990).

The beneficial effects of *A. racemosus* on disorders such as dysmenorrhea and premenstrual syndrome as well as irregular bleeding during perimenopause and postmenopausal conditions stem from its active ingredients. The presence of saponins in *A. racemosus* blocks oxytocic effects on uterine muscles to maintain natural uterine movement and proves its capability to treat dysmenorrhea which manifests as painful periods without underlying pelvic disease (Gaitonde & Jetmalani, 1969).

Safety of *Asparagus racemosus*

The test product demonstrated safety and tolerance with no severe adverse events in individuals experiencing menopausal symptoms like hot flashes and anxiety. The study findings demonstrate that a new Shatavari formulation taken at a daily dose of 250 mg twice for 60 days offers positive therapeutic effects for psychological and somatic conditions associated with menopausal syndrome. The novel Shatavari formulation could be an acceptable substitute for existing treatments based on these findings (Gudise et al., 2024).

Botanical Distribution of *Actaea racemosa*

The scientific name for Black cohosh is *Actaea racemosa* while also being referred to as *Cimicifuga racemosa* [L.] Nutt. and belonging to the *Ranunculaceae* family. Mahady et al. (2002) through research and supporting evidence of Geller & Studee (2005) and Mahady (2005) established that *Cimicifuga racemosa* [L.] Nutt. Belongs to the *Ranunculaceae* family and exists as a coarse perennial woodland herb with its phytochemical effects stemming from thick knotted rhizome (root) system.

The pharmacological effects of *Cimicifuga racemosa* stem from its phytochemical content of triterpene glycosides, phenolic acids, flavonoids, and alkaloids. Triterpen glycosides constitute the main active components of actein and cimicifugoside that act to modulate estrogen levels within the body according to research by Burdette et al. (2003). Black cohosh rhizomes were used by Native American Indians to treat coughs, colds, constipation, exhaustion, and rheumatoid arthritis, as well as to increase breast milk production. A tincture of black cohosh rhizome was used in 1832 to treat pain and inflammation associated with endometriosis, rheumatism, neuralgia, and dysmenorrhea (Mahady, 2005). Its therapeutic uses include medication for menstrual pain, premenstrual symptoms, menopausal symptoms, and muscle and joint pain related to rheumatoid arthritis. It is classified as dietary supplements or herbal treatment.

Chemical Constituent

Plants contain bioactive compounds known formally as secondary metabolites or phytochemicals which determine their colors and fragrances. Different secondary metabolites from sterols to triterpenes including alkaloids and flavonoids lead to vital functions in physiology and nutrition and disease therapy (Sahreen et al., 2011, Jan et al., 2021). Scientific evaluation reveals that phytochemical elements exist in both aerial plant samples (stems, leaves, flowers and fruits) and subterranean plant specimens (roots and rhizomes). Investigations show that CR rhizomes harbor specific phytochemicals mainly consisting of alkaloids, flavonoids, phenols and triterpene glycosides. The other minor compounds found in CR include cinnamic acid esters (cimicifugic acid, cimicifugic acid A–F, cimiracemates A–D, fukiic acid, piscidic acid, and fukinolic acid), resin, phytosterol, fatty acid, starch and sugar along with aromatic acids (ferulic acid, isoferulic acid, caffeic acid, and caffeic acid methyl esters) (Kruse et al., 1999; Li et al., 2002). This plant includes alkaloids with methyl cystine and methyl serotonin as well as anagyrine and baptifoline and magnoflorine and a variety of quinoline and quinolizidine alkaloid subtypes. There are uncharacterized alkaloids among newly detected compounds which exist in minute quantities. The composition includes phosphoric acid and starch with phytosterol and cholines as well as gum and resin and tannins and citrullol along with betaine.

Pharmacological action of Shatavari Related to Hormonal Health

Women in menopause often use CR because of its estrogenic effects that helps to relieve depression, hot flashes, and may also offer some degree of protection against bone loss. (Winterhoff et al., 2003; Qiu et al., 2007). Instead of directly influencing estrogen, it acts on serotonin and could interact with 5-HT1A, 5-HT1D and 5-HT7 receptors (Burdette et al., 2003). Studies indicate that CR extract possesses a compound known as Nω-methyl serotonin that acts on 5-HT1A and 5-HT7 receptors modulating the receptors of serotonin (Powell et al., 2008; Nikolić et al., 2014). A CR extract is a mixed competitive ligand that captures serotonin receptors, particularly 5-HT7 and 5-HT 1A, which are served by the hypothalamus for thermoregulation similar to the selective serotonin SSRIs but with some adverse effects. (Burdette et al., 2003; Hedlund & Sutcliffe, 2004). The 5-HT1A influences serotonin re-uptake through its interaction with the serotonin transporter in the hypothalamus. Therefore, CR extract may contain substances that alleviate postmenopausal hot flashes symptom through this mechanism (Rhyu et al., 2006).

Selective serotonin reuptake inhibitors (SSRIs) have been shown to significantly diminish the number of hot flashes and anxiety in postmenopausal women, which indicates the importance of serotonin 5-HT in these symptoms. It has been established that CR extract contains Actein and Deoxyactein, two triterpenes that help in the skeletal system development for post-menopausal women. "Deoxyactein increases cell proliferation and mineralization 'while' Actein decreases oxidative damage to January 2017 osteoblasts" (Choi, 2013; Lee & Choi, 2014; Suh et al., 2017; Zakir et al, 2020). Besides, CR extract is also useful for diabetes, neoplasia, sarcopenia, cardiac insufficiency, obesity, and other diseases (Nadaoka & Sugiyama, 2006; Einbond & Weinstein, 2008; Boonen, 2023).

Health Risk

Multiple formulations of this herb during menopause have been clinically tried out, and the study reports show minimal side effects among women (Mahady et al., 2008; Teschke et al., 2016).

Vitex Agnus-castus

The *Vitex agnus-castus L.* plant grows as a low tree or tall shrub that reaches heights between 3 to 6 meters. It adapts to growth in two different forms including prostrate creeping spread and low upright shapes. A mixture of light gray with a pink hue covers the bark but juvenile growth displays a browish coloring scheme. The leaves of the plant feature thin palmate shape extending cm lengthwise and proving 12 - 8 cm wide in total. Each Valeriana petals appear as purple, whi14 - 12te, pale pink, pink, dark pink or lilac. Prutnyak fruits serve as a substitute choice because they provide a similar appearance to black pepper (Karaguzel & Girmen, 2009; Mammadova & Mammadova, 2019).

Chemical Constituents

The essential oil composition of the chaste tree fruits consists mainly of flavonoids together with iridoids along with phenol carboxylic acids and terpenoids. Through spectral and chromatographic analysis scientists have detected more than sixty compounds within the fruits. Flavonoids together with iridoids comprise the most dominant group of substances detected in these substances. Natural compounds of the fruits contain casticin and luteolin-7-glycoside as primary flavonoids. Other notable compounds found in the fruits are lutein, 3,3′-dihydroxy-5,6,7,4′-tetramethoxyflavone, 3,7-dimethylquercetin, 3-O-methylkaempferol, 3-hydroxy-5,6,7,4-tetramethoxyflavone, 3-methylquercetin, 3-methylkaempferol, 5,3′,5′-trihydroxymethoxyflavanone, 5,7,3′,5′-tetrahydroxyflavanone, apigenin, artemetin, vitexin, orientin, isovitexin, isoorientin, kaempferol, penduletin, and eupatorin (Sørensen & Katsiotis, 2000; Hajdú et al., 2007; Choudhary et al., 2009; Makhmoor & Choudhary, 2010; Chen et al., 2011; Mari et al., 2015; Sogame et al., 2019). The essential oil extracted from mature dried chaste tree fruits contains various compounds that include α-pinene and sabinene together with β-myrcene, β-pinene, p-cymene, limonene, 1,8-cineole, cis-sabinene hydrate, trans-sabinene hydrate, cis-p-ment-2-en-1-ol, trans-verbenol, δ-terpineol, terpinene-4-ol, krypton, α-terpineol, trans-carveol, β-citronelol, and α-terpinyl acetate (Sorensen & Katsiotis, 1999; Stojković et al., 2011; Ghannadi et al., 2012).

Hormonal Health Related Effects of Chaste tree

Having elevated blood prolactin levels from chronic stress often causes mastodynia symptoms as well as changes in the mammary gland and infertility problems. The dopamine receptors in the pituitary gland become active when stimulated by chaste tree chemicals thus enabling reduction of blood prolactin levels and their accompanying negative impact. Multiple research studies in laboratories as well as clinical investigations have confirmed these properties. The entire extract of chaste tree fruits successfully reduced prolactin output from pituitary gland cells in mice according to Sliutz et al. (1993). Synthetic dopamine receptor agonists demonstrated identical results on pituitary gland cell behavior as the natural compounds did. Scientists studied the binding behavior of chaste tree ethanol extract using radioligand method on four receptor types: D2-dopamine, H1-histamine, benzodiazepine receptors and opioid receptors together with the serotonin transporter binding site. Research results showed that the dopaminergic effect was more prominent in the hexane fraction than in the entire extract. Studies focused on BNO 1095 confirmed that terpenoids in bicyclic structures caused dopaminergic effects but failed to detect any connections between the histamine transporter and benzodiazepine receptor or histamine receptor according to Meier et al. (2000). Research findings show that the flavonoids apigenin, penduletin, vitexin have estrogenic properties with the reported IC50 values as 0.08 for apigenin while penduletin has an IC50 value of 0.25 and vitexin has an IC50 value of 10 μg/ml. Research shows that the basic extract of BNO 1095 induces a response block of 50%. The presence of linolenic acid in chaste tree fruits enhances PMS treatment effect because it amplifies expression of the β-estrogen receptor gene in Ishikawa cells. Scientific research demonstrated that the methanol extract can remove estrogen from every type of these receptors according to Jarry et al. (2003) and Liu et al. (2004).

Conclusion

Hormones are essential for women's overall wellbeing, influencing reproductive, mental, and metabolic health. Natural remedies such as Vitex agnus-castus, Actaea racemosa, and Asparagus racemosus show promise in addressing issues like PMS, menopause, and hormone imbalances. Nevertheless, there is a need for more comprehensive safety profiles, standardized herbal formulations, and clinical studies to effectively incorporate these treatments into contemporary medical practices. Merging traditional herbal medicine with modern scientific validation can lead to personalized, safe, and effective solutions for women's hormonal health.

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