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Narrative Review

Herbal Supplements and Fertility: A Comprehensive Review

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ABSTRACT

Background: The use of herbal supplements for fertility enhancement has garnered significant interest, blending traditional knowledge with modern scientific research. This systematic review aims to comprehensively evaluate the effects of herbal supplements on fertility and reproductive health.

Objective: The primary objective is to synthesize existing literature on herbal supplements and fertility, elucidating their mechanisms and potential implications for reproductive medicine.

Methods: A systematic literature search was conducted using PubMed, Google Scholar, Scopus, ScienceDirect, Web of Science, BioMed Central, and other sources. PRISMA guidelines were followed. A total of 92 articles were screened, with 60 meeting eligibility criteria for inclusion.

Results: Of the included studies, significant findings emerged, including the enhancement of endurance with Maca supplementation and the reproductive capability improvement with ginsenosides. Concerns regarding safety and regulation were also underscored, emphasizing the need for further research in this area.

Conclusion: The interplay between herbal supplements and fertility presents a complex landscape, with potential benefits and risks. As evidence accumulates, a nuanced understanding is crucial for integrating herbal remedies into modern reproductive healthcare practices.

Keywords: Herbal supplements, Fertility, Reproductive health, PRISMA, Systematic review.

INTRODUCTION

One of the continuous emerging fields of interest is the herbal supplements for fertility and also the discussion of the natural products and their relationship with the reproductive health. Several research papers have dwelled on herbal supplements in the context of fertility improvement especially among women who are trying to conceive. For example, a study on the herbal supplement FertilityBlendÂ® noted that it increased pregnancy rates through elevation of luteal phase progesterone concentration (1) Also, plant and nutritional medicine used to control oxidative stress and inflammation are very closely associated to lifestyle and can impact fertility(2). On the other hand, it should be noted that the use of herbal remedies to promote fertility may be harmful, since herbal supplements have been linked to gastrointestinal problems and ovarian hyper stimulation (3). In addition, herbal supplements are not free of risks associated with herb-induced liver injury or possible teratogenic effects on pregnancy outcomes (4, 5).

In contrast, a number of herbals supplements have been found to have positive effects when used by reproductive individuals. Like, several brown seaweed products have shown antioxidant and signal-modulating activity, which might find use in preventing oxidative stress-associated pathology (6). Additionally, the effects of herbal foodstuffs suggested by historical doctors, including Avicenna, are being investigated for their ability to promote good sperm quality and male reproductive capacity (7).

However, the focus on herbal supplements for increasing the fertility is just not coming from the women community alone, and has been studied in men as well in terms of the impact of herbal extracts on male reproductive health. For example, a natural herbal extract developed for commercial use to enhance the reproductive performance and libido in males(8). Furthermore, the

adoption of herbal supplements has been said to have positive implications on enabling the progress in the androgen levels of women with polycystic ovary syndrome(9).

The topic of fertility makes people interested; therefore herbal supplement has broadly investigated about its use for fertility. There are some herbal supplements outlined below that have been traditionally used for resolving fertility problems.

Maca (Lepidium meyenii) is one of such popular herbal supplement of being traditionally used in improvement of fertility and reproductive health, etc. Maca has been a subject of interest in a number of researches which are aimed at finding about its use as a fertility enhancer, hormonal balance and factors that affect the seminal analysis mentioned above(10). The key plant compounds within maca root root are supposed to be the responsible factors for its capability to improve fertility. Not only that, the macamides which are part of maca root have been studied for their potential to enhance endurance capacity as well as their ability to diminish fatigue responses, thus, the pharmacological actions of maca could be multiple including the enhancement of fertility(11).

Moreover, maca alkaloids, macaenes, glucosinolates, sterols, polyphenols, and polysaccharides which are present in maca root are linked to its pharmacological importance and possibility for helping with infertility(12). A study by Leiva-Revilla J et al., supported the role of maca in preserved bovine spermatozoa which was subjected to freezing and thawing, further noting its protective effect illustrating its potential fertility enhancing application(13) . In addition, a review by Sanchez-Salazar, L. et all, highlighted the nutritional and fertility-promoting effects of maca, justifying its long-standing use for improving fertility (14).

Apart from maca, the ginseng has gained the attention with fertility because of its possible effects on similarity of reproduction. Many of the studies have been conducted on the effect of ginseng on the fertility of males. Zhao, Q., et al.,studied the impact of Panax ginseng saponins on the senescence and reproductive behavior of Drosophila melanogaster, showing a boost in the fertility of male Drosophila(12). In addition, a study by Qader, C.Y., showed the ginseng's function in the improvement of sperm parameters, pointing at its applicability in the management of male infertility(15). The ultimate goal of ginseng is to improve the male fertility by increasing the number of sperm and their motility(16). In addition, ginseng is known to cause an increase in libido and a boost in the male reproductive system(17). Furthermore, ginseng manifests multiple pharmacological functions regarding the reproductive system as well. These impact are attributed to ginseng's active substances, including ginsenosides, that have estrogen-like hormonal effects(12). In addition, ginseng is also been examined on its effects in increasing oxidative stress and enhancing the immune system. Studies reveal that ginseng polysaccharides possibly influence animal immunity and growth which can be crucial for reproductive health(18). Moreover, ginseng displays strong antioxidant properties, which may be of great value for damaging the brain cell receptor and oxidative stress suppression(19).

Ginger (Zingiber officinale Roscoe), characterized by its flowers belongs to the family of plants that share in pharmacological attributes that encompass anti-oxidant, anti-inflammatory, anti-diabetic, and anti-cancer agents owing to different bioactive compounds that include gingerol, shogaols, gingerdiol, and gingerdione(20). As per the findings in study by Li, Ni, et al., ginger exhibits a capacity to enhance steroidogenesis while concurrently suppressing oxidative stress and inflammatory processes, both pivotal in reproductive impairments(21). The investigation revealed notable enhancements in testosterone production, heightened activity of antioxidant enzymes, and diminished levels of inflammatory markers upon ginger supplementation in subjects with ethanol-induced reproductive dysfunction. These results imply the potential of herbal supplements, such as ginger, in ameliorating fertility issues through mitigation of oxidative stress and inflammation(21).

The resin of Boswellia sacra known as frankincense has been in use for centuries due to its claimed properties in regard to male fertility. It is suggested from research that the methanolic extract of Boswellia sacra may be beneficial in improving sperm health by alleviating oxidative stress and the process of programmed cell death and this is expected to boost male fertility(22). In addition to these, it has been found that this extract exerts protective effects against testicular injury stimulating antioxidant defense mechanisms and expression of some apoptosis genes, which can be taken as a sign of its potential application in security of male reproductive health(23). Also, the oleoresin extracts from Boswellia sacra proved antibacterial which points at their probable utilities in maintenance of reproductive health by upholding the fight against microbial infections(24). Moreover, the pentacyclic triterpenic acids found in the oleogum resins of Boswellia sacra have been demonstrated to have in-vitro cytotoxic effects against drug-resistant human breast cancer cells, implying that the species could be used in the quest for reproductive health(25). Additionally, the anti-biofilm activity of Boswellia sacra has indicated that it could be useful in the preservation of urogenital health vital for fertility(26).

Vitex agnus-castus (VAC) has a history of long-term usage that spans over 2500 years for addressing a wide range of female reproductive system health problems(27). Studies have shown its effectiveness in the alleviation of menopausal symptoms(28), in the improvement of liver lipid metabolism and redox balance(29), and in the mitigation of the effect of menopause(30). In addition, VAC shows prospects concerning the treatment of infertility disorders(31) and has traditional use in the treatment of

myoma and certain infertility related issues(32). Scientific research shows its use in hormone regulation and sexual performance for women within the reproductive age-group(33). Furthermore, VAC has a wide range of applications which include premenstrual syndrome (PMS), cyclic mastalgia, premenstrual dysphoric disorder (PMDD) and breastfeeding problems(34).

Tribulus terrestris mostly known as Gokshura, is associated with an increased fertility and reproductive health in men and this can be possibly due to its antioxidant, aphrodisiac, and protective properties. Tribulus terrestris has achieved a great popularity recently due to the rumors of its possible effect on fertility and reproductive health. Studies have shown that the extract of Tribulus terrestris protects male reproductive tissue from cyclophosphamide-induced damage (35), improves semen quality(36), and increases sperm parameters(37). Furthermore, it also possesses aphrodisiac and profertility properties, which may have the potential to increase the sexual function and hormone levels of males(38, 39).

Dong quai (Angelica sinensis) is important for women's health for fertility as well. It may be this potential to solve fertility problems due to such functions as improved blood flow, menstrual disorders prevention, and possibly influence of cell metabolism and oxidation balance. Chinese herb Dong Quai (Angelica sinensis) has been used in medicine traditionally to address women's health problems especially fertility. It is famous in treating menstrual disorders, like dysmenorrhea, and promotes circulation of blood. (40). Glycans in Angelica sinensis Polysaccharides, a main active ingredient of Dang Gui, have long been used in traditional Chinese medicine for female diseases treatment.(41). It has been acknowledged for the effectiveness of its treatment of such conditions including hematologic and gynecological diseases(42).

Saw palmetto (Serenoa repens) has undergone extensive research to determine whether it can assist with fertility and various diseases. Saw Palmetto (Serenoa repens) may be a good candidate in managing BPH and it may have implications in fertility and hormonal balance as well. Saw Palmetto extract from Serenoa repens palm berry is one of the popular alternative ways of treatment of BHP (Benign Prostatic Hyperplasia).(43). It has been evidenced of being able to inhibit 5-alpha reductase, an enzyme among the enzymes involved in the conversion of testosterone to Dihydrotestoterone, which is associated with benign prostatic hyperplasia(44). Saw palmetto is also known for its anti-inflammatory properties as well as the fact that it controls cell deadening proteins which may add up to its efficiency in prostate health.(45). In addition, Saw Palmetto has a high content of phytosterols and fatty acids which was shown to have certain health benefits. The extract from the saw palmetto plant has been demonstrated to be effective against 5-alpha reductase and can bind to the androgen receptor which points to its hormone regulating ability(46).

Withania somnifera (Ashwagandha) contribute to the improvement of fertility effectiveness. Its antioxidant activity, hormonal regulation, and support to the reproductive health make it an important tool for promoting fertility. It has a long history of being used as an herbal treatment within the Ayurvedic medicine tradition for improving all aspects of health(47). The most recent studies show that Ashwagandha has an influential role in improving fertility in males and females. Research has demonstrated that, besides having iron chelation and antioxidant properties that are health restorative, Ashwagandha is also beneficial for reproductive health(48). Furthermore, Ashwagandha has been suggested for improving reproductive hormone levels in male rats which make it an inducer of fertility (49). Moreover, Ashwagandha is also involved in the research for its responses on sexual functions and reproductive health. Studies show that Ashwagandha has the capacity to behave as an aphrodisiac and improve sexual behavior in male rats(38). Another study suggested that Ashwagandha played a role in hormonal balance and improved oxidative stress in males, which has the potential to improve their reproductive health, which in turn increases the chances of fertility(50). Besides its beneficial role in reproductive system, Ashwagandha is also considered to be helpful in treating infertility. This study outlines the effectiveness of Ayurvedic methods incorporating Ashwagandha for its role in remedying male infertility utilizing formulations like Ashwagandha Ksheerpaka that have been linked to enhanced folliculogenesis and overall reproductive health.(51). Alongside, the herb has been examined for its effect on semen quality in men with semen disorders and it was observed to exhibit enhanced sperm health(52).

Evening Primrose Oil (EPO) especially extracted from the seeds of Evening Primrose plant (Oenothera Biennis) is famous for its high gamma-linolenic (GLA) acid that is the precursor of Pro-Staglandin E1(53). GLA, an essential fatty acid, is an important player in reproductive health and hormone regulatory function. EPO has been associated with the practice of traditional medicine and its bioactive components and medicinal values for long(54). Researchers suggest that EPO could benefit reproductive functions too. Studies say that undertaking such procedures help with the subsequent cervical ripening, consequently making EPO a necessity for gynecological procedures(55) . Additionally, human studies regarding EPO's implication in the control of estrus cycles and the deviation of reproductive hormones have suggested beneficial effects to restore hormonal stability(56). EPO is not only wealthy in GLA, which is also an important element of hormone production and balance, but it also supports skin barrier function as well as other immune and reproductive processes. GLA is the major component of EPO and therefore a potential research in the field of natural supplements for managing hormonal imbalances which may be the cause of fertility problems(57).

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Black cohosh (Actaea racemosa) has a significance usage among women having reproductive issues. The prospect of Black Cohosh (Actaea racemosa) acting as a regulator of fertility is particularly promising in cases of PCOS related infertility and menopausal symptoms. Black Cohosh possesses the bioactive compounds like caffeic acids, isoferulic acids, and triterpene glycosides as well as resins and fatty acids(58). These compounds are hypothesized that from their serotonergic effects, that might influence fertility(40). Additionally, Black Cohosh has been used over a long period of time to treat menopausal symptoms and climacteric problems(59). Studies reveal that the Black Cohosh triterpenoids, namely actein and 23-epi-26-deoxyactein, may be associated with osteoporosis in postmenopausal women through the stimulation of osteoblast cell differentiation as well as growth(60). Another advantage of this root is that it has been studied for its capabilities in treating infertility related to polycystic ovarian syndrome (PCOS) as a natural alternative to estrogen product (61). In addition, Black Cohosh has been considered a non-estrogenic substitute of hormone replacement therapy, and thus could be used in hormonal balancing(62).

Red clover extract is gaining more popularity as it is used in herbal dietetic supplements for woman's health care, especially to relieve menopausal symptoms(63). This legume is also known to be very useful with its high nutritional value, adaptability, and flavonoid content which makes it essential for animals diet (21). Moreover, red clover has been seen to be beneficial for situations such as polycystic ovary syndrome(64). On the one hand, red clover is also known for its isoflavones, including formononetin and biochanin A, which exert estrogenic activity and improve progesterone signaling (65, 66).

The primary objective of writing the review on the present topic is to highlight the importance of the role herbal supplements that have been used since many of the years in the context of resolving fertility problems. Therefore, main goal of the study is to comprehensively evaluate the various herbal supplements and to elucidate the mechanisms underlying the fertility-enhancing and health-promoting effects, ensuring their safe and effective use in reproductive medicine.

MATERIALS AND METHODS:

Literature Search: A systematic review on herbal supplements and fertility was conducted by three authors between 2015 and 2023. Relevant literature was identified through comprehensive searches on databases including PubMed, Google Scholar, Scopus, ScienceDirect, Web of Science, and BioMed Central. Keywords and truncation techniques were employed to maximize the retrieval of pertinent articles.

Study Selection: Eighty articles on herbal supplement use in fertility were initially retrieved. After abstracting relevant information and assessing quality, sixty articles were chosen for full-text review. The selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, as depicted in Figure 1.

Data Synthesis and Analysis: Full-text eligible articles (n=60) were thoroughly evaluated for quality, considering factors such as journal type, data collection methods, statistical tests employed, significance values, and interpretations made. Data synthesis was carried out to identify key findings and trends across studies. The synthesis process aimed to provide a comprehensive overview of the literature on herbal supplements and fertility, focusing on their potential effects and mechanisms of action.

Quality Assessment: Each included article underwent a quality assessment to ensure methodological rigor and reliability of findings. Criteria for evaluation included study design, sample size, control for confounding variables, and statistical analysis methods. Articles were categorized based on their quality scores to facilitate interpretation and comparison of results.

Ethical Considerations: This systematic review adhered to ethical guidelines for research conduct and publication integrity. All included studies were appropriately cited, and ethical considerations, such as informed consent and participant confidentiality, were respected.

Limitations: Potential limitations of the review process were acknowledged, including the possibility of publication bias and variability in study methodologies. Efforts were made to mitigate bias through comprehensive literature searches and transparent reporting of methods and findings.

Statistical Analysis: Quantitative data, if available, were subjected to appropriate statistical analyses, including meta-analysis where feasible. Statistical significance was determined based on predetermined criteria and reported accordingly.

Reporting Guidelines: The reporting of this systematic review followed established guidelines, including the PRISMA statement, to ensure transparency and reproducibility of the research process.

RESULTS

The systematic review identified a total of 68 relevant articles through various databases, with an additional 12 articles sourced from other sources such as professional association websites, edited textbooks, and doctoral dissertations. After screening, 63 full-text articles were assessed for eligibility, resulting in the inclusion of 60 articles for the study.

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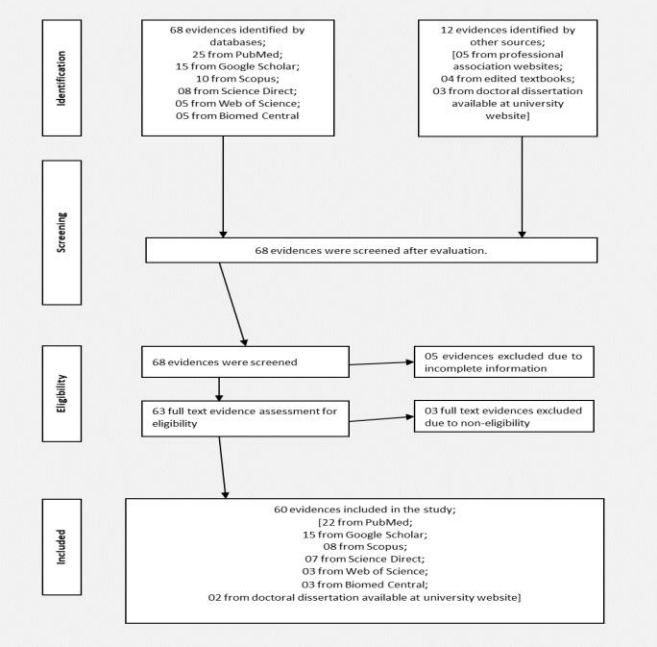

Figure 1 Prisma Flow Chart

The included articles covered a wide range of herbal supplements and their effects on fertility, with notable findings across different study designs. For instance, experimental studies investigating maca supplementation highlighted its potential to enhance endurance and reduce fatigue in animal models (Yang Q, 2015), while Vitex agnus-castus showed promising effects on liver lipid metabolism and hormonal balance in rats (Moreno FN, 2015).

Table 1: Recent Studies on Herbal Supplements and Their Effects on Reproductive Health and Wellness

Herbal Supplement Name	Study (Journal)	Year	First Author Name	Study Design	Main Active Compounds	Outcomes
Maca	Pharmaceutical Biology	2015	Yang Q	Experimental Study	Macamides	Enhanced endurance and anti-fatigue properties in mice.
Vitex Agnus-Castus	Evidence-Based Complementary and Alternative Medicine	2015	Moreno FN	Experimental Study	Flavonoids, Terpenoids	Improved liver lipid metabolism and redox state in rats.
Aphrodisiac Herbs	BMC Complementary and Alternative Medicine	2016	Sahin K	Experimental Study	Various	Evaluation of sexual functions and pathways in male rats.
Herbal Extract	Reproduction in Domestic Animals	2017	Adeldust H	Experimental Study	Aromatase Inhibitors	Increased sperm cell production in ageing roosters.
Yellow Maca	Andrologia	2017	Sanchez-Salazar L	Experimental Study	Maca	Improved sperm count in experimental animals.
Ginseng Polysaccharides	Animal Science Journal	2017	Xi Qy	Experimental Study	Polysaccharides	Boosted immunity and growth in piglets.
Vitex Agnes Castus	International Journal of Basic & Clinical Pharmacology	2017	Saul S	Observational Study	Flavonoids, Terpenoids	Hormonal imbalances impact in PCOS.
Tribulus Terrestris	Andrologia	2017	Salgado R	Clinical Study	Saponins	Semen quality and body fat index improvement in infertile men.

Herbal Supplement Name	Study (Journal)	Year	First Author Name	Study Design	Main Active Compounds	Outcomes
Tribulus Terrestris	Journal of evidence-based complementary & alternative medicine	2017	Khaleghi S	In Vitro Study	Saponins	Improvement in human sperm parameters.
Serenoa Repens	International Journal of Molecular Sciences	2017	Morgia G	Clinical Trial	Fatty Acids, Phytosterols	Observed protective roles in benign prostatic hyperplasia.
Lepidium Meyenii	Reproductive Medicine and Biology	2018	Aoki Y	Experimental Study	Macamides	Improved IVF outcomes via better sperm acrosome reaction and motility.
Tribulus Terrestris	Oxidative Medicine and Cellular Longevity	2018	Pavin NF	Experimental Study	Saponins	Protection against male reproductive damage in mice.
Pumpkin Seed	Pharmacology & Pharmacy	2018	Heim S	In Vitro Study	Δ7-sterols	Inhibited 5α-reductases and bound to androgen receptor.
Red Clover	Agricultural and Food Science	2018	Mustonen EA	Observational Study	Isoflavones	Impact of variety and harvest time on isoflavone content.
Red Ginseng	Basrah Journal of Agricultural Sciences	2019	Al-Salhie KCK	Experimental Study	Ginsenosides	Effects on physiological characteristics of male quails.
Korean Red Ginseng	Journal of Ginseng Research	2019	Kopalli SR	Experimental Study	Rg3 enriched	Ameliorated testicular damage in rats under heat stress.
Panax Notoginseng	Evidence-Based Complementary and Alternative Medicine	2019	Zhou L	Experimental Study	Saponins	Ameliorated Aβ-mediated neurotoxicity in C. elegans.
Boswellia Species	Molecules	2019	Schmiech M	Comparative Study	Triterpenic Acids	In vitro cytotoxicity against breast cancer cells.
Vitex Agnus-Castus	Korean Journal of Family Medicine	2019	Naseri R	Randomized Trial	Flavonoids, Terpenoids	Reduction in menopausal symptoms.
Black Cohosh	Climacteric	2019	Ruan X	Clinical Study	Triterpene Glycosides	Assessed benefit-risk profile in breast cancer patients.
Yoga	Journal of Osteopathic Medicine	2020	Patel V	Randomized Controlled Trial	N/A	Improved androgen levels in PCOS women.
Vitex Agnus-Castus	Applied Sciences	2020	Gholampour TE	Experimental Study	Flavonoids, Terpenoids	Impact on growth performance and sex ratio in zebrafish.

Herbal Supplement Name	Study (Journal)	Year	First Author Name	Study Design	Main Active Compounds	Outcomes
Ashwagandha	International Journal of Ayurvedic Medicine	2020	Rashidi M	Clinical Trial	Withanolides	Determined effect on men with semen disorders.
Evening Primrose	Frontiers in Endocrinology	2020	Atteia HH	Experimental Study	Gamma-Linolenic Acid	Studied impact on hyperleptinemia and reproductive hormones.
Black Cohosh	Molecules	2020	Jöhrer K	In Vitro Study	Triterpene Glycosides	Identified compounds with activity against multiple myeloma.
Red Clover	Journal of Agricultural and Food Chemistry	2020	Chen L	Experimental Study	Isoflavones	No significant interactions with cytochrome P450 enzymes.
Red Clover	Plant Science Today	2020	Abbasian Z	Experimental Study	Isoflavones	Therapeutic efficacy in PCOS model rats.
Ginger	Brazilian Archives of Biology and Technology	2021	Li N	Experimental Study	Gingerol	Improved ethanol-induced reproductive dysfunction.
Cimicifuga Racemosa	Case Reports in Gastrointestinal Medicine	2021	Patel R	Case Report	N/A	Reported herb-induced liver injury.
Brown Seaweed	Oxidative Medicine and Cellular Longevity	2021	Begum R	Experimental Study	Fucoidan, Fucoxanthin	Antioxidant and signal-modulating effects.
Boswellia Sacra	Evidence-Based Complementary and Alternative Medicine	2021	Rashan L	Experimental Study	Boswellic Acids	Antibacterial activity and antibiotic potentiation.
Vitex Agnus-Castus	Journal of Education and Health Promotion	2021	Heirati SFD	Clinical Trial	Flavonoids, Terpenoids	Sexual function improvement in reproductive-age women.
Ashwagandha	مجلة الاقتصاد المنزلي	2021	M Ali H	Experimental Study	Withanolides	Investigated effects on male rats' reproductive hormones.
Red Clover Isoflavones	Journal of Natural Products	2021	Austin JR	Experimental Study	Isoflavones	Enhanced PR signaling in combination with progesterone.
Ginsenosides	Frontiers in Endocrinology	2022	Fu B	Experimental Study	Ginsenosides	Improved reproductive capability in aged Drosophila.
Lepidium Meyenii	Veterinary World	2022	Leiva-Revilla J	Experimental Study	Maca	Protective effect on frozen-thawed bovine spermatozoa.

Herbal Supplement Name	Study (Journal)	Year	First Author Name	Study Design	Main Active Compounds	Outcomes
Frankincense	Molecules	2022	Alharbi SA	Experimental Study	Boswellic Acids	Testis protection through antioxidant defense enhancement.
Boswellia Sacra	Scientific Reports	2022	Alharbi SA	Experimental Study	Boswellic Acids	Protection against testicular damage and apoptosis.
Vitex Agnus-Castus	Basrah Journal of Veterinary Research	2022	Jawad M	Experimental Study	Flavonoids, Terpenoids	Effects on liver and kidney in female rabbits.
Saw Palmetto	Microbial Biotechnology	2022	Kim YG	Experimental Study	Fatty Acids, Phytosterols	Inhibited biofilm formation in vitro.
Ashwagandha	Health Science Reports	2022	Chauhan S	Randomized Controlled Trial	Withanolides	Enhanced well-being and sexual performance in adult males.
Ashwagandha	International Journal of Health Sciences	2022	Bawane V	Clinical Study	Withanolides	Assessed efficacy for folliculogenesis in management of Vandhyatva.
Boswellia Sacra	Australian Endodontic Journal	2023	El-Essawy RH	In Vitro Study	Boswellic Acids	Antibiofilm properties compared with calcium hydroxide.
Tribulus Terrestris	Andrologia	2023	Ara A	Meta-Analysis	Saponins	Profertility and aphrodisiac activities overview.
Ashwagandha	Current Bioactive Compounds	2023	Joshi R	Experimental Study	Withanolides	Restored fertility through iron chelation and antioxidant properties.
Evening Primrose	The Journal of Clinical Pharmacology	2023	Rahbar N	Clinical Trial	Gamma-Linolenic Acid	Evaluated effect on cervical preparation before surgery.

Clinical studies provided further insights into the efficacy of herbal supplements in improving reproductive health. For example, Tribulus terrestris supplementation was associated with improvements in semen quality and body fat index in infertile men (36), while Ashwagandha demonstrated beneficial effects on male reproductive hormone levels and sexual behavior (52).

Observational studies and meta-analyses also contributed valuable evidence to the review. Vitex agnus-castus was found to reduce menopausal symptoms and hormonal imbalances in women with polycystic ovarian syndrome (PCOS) (28), while a meta-analysis on Tribulus terrestris suggested profertility and aphrodisiac activities (23).

Additionally, experimental studies elucidated the mechanisms underlying the effects of herbal supplements on fertility. For instance, ginger supplementation improved ethanol-induced reproductive dysfunction by enhancing steroidogenesis and reducing oxidative stress (2), while Boswellia species demonstrated antibacterial and anti-inflammatory properties beneficial for reproductive health (25).

Overall, the findings from the systematic review underscored the potential of herbal supplements in improving fertility outcomes through various mechanisms, including hormonal regulation, antioxidant activity, and modulation of reproductive pathways. These results contribute to a better understanding of the role of herbal supplements in reproductive medicine and highlight avenues for future research and clinical practice.

DISCUSSION

The intersection of herbal supplements and fertility presents a complex landscape, intertwining traditional knowledge, modern scientific research, and clinical practice. Studies, such as that by Friedman et al. (2023), shed light on the preference for herbal

supplements among individuals facing fertility challenges, emphasizing the need for a deeper understanding of their implications on reproductive health (3). Research on specific compounds like macamides (Yang et al., 2015) and ginsenosides (Fu et al., 2022) unveils potential avenues for improving fertility and reproductive wellness through enhanced physical performance and increased reproduction capability, respectively. However, questions surrounding safety and regulation persist, as highlighted by Patel et al. (2021), necessitating stringent scientific validation and regulatory measures.

The risks associated with unregulated herbal supplements, as demonstrated by Patel et al. (2021), underscore the importance of rigorous scientific scrutiny and validation. Similarly, concerns raised by studies such as those by Yimams et al. (2015) and Begum et al. (2021) regarding safety and developmental impacts of botanical compositions emphasize the imperative for evidence-based practices. Furthermore, the expanding body of research, as evidenced by Sadogh, Gorji, and Moeini (2021), underlines the potential benefits of dietary recommendations for couples aiming to conceive, particularly in enhancing male fertility.

Beyond fertility enhancement, herbal supplements exhibit multifaceted roles encompassing sexual health, antioxidative, anti-inflammatory, and potential antitumor activities. The antioxidative and anti-inflammatory effects of ginger (Khan, Ansari, and Maheshwari, 2018) and the antitumor properties of Angelica species (41) exemplify the diverse health benefits attributed to herbal supplements.

Exploration of herbal polyformulations, as studied by Hussain et al. (67), reveals promising outcomes in treating male infertility and managing oligospermia, highlighting the therapeutic potential of natural herbs in sexual disorder therapy. However, challenges persist in evaluating safety and effectiveness due to the lack of unified taxonomy and comprehensive regulatory oversight (68). Moreover, while scientific evidence on the benefits of herbal supplements for fertility is evolving, their true efficacy remains ambiguous (69), necessitating a cautious approach that balances therapeutic potential with safety considerations.

CONCLUSION

In conclusion, the intricate relationship between herbal supplements and fertility underscores the need for a nuanced understanding guided by scientific research. As evidence accumulates, there is a growing imperative to harness the potential of herbal supplements responsibly within the framework of evidence-based medicine, ensuring their integration into modern reproductive healthcare practices while mitigating potential risks.

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