Chettinad Health City Medical Journal
Volume 13, Issue 3 - 2024, Pg. No. 99-108
Peer Reviewed & Open Access Journal

Review Article

An Analysis of Medicinal Plants in the Management of Male Infertility

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DOI: https://doi.org/10.24321/2278.2044.202450

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How to cite this article:
Khadar B A A, Suganthi V. An Analysis of Medicinal Plants in the Management of Male Infertility. Chettinad Health City Med J. 2024;13(3):99-108.

Date of Submission: 2023-10-25
Date of Acceptance: 2023-11-20

A B S T R A C T

Infertility, coupled with issues related to sexual dysfunction, has long been a pressing global concern, affecting approximately 15% of couples. Interestingly, males shoulder the sole responsibility, which results in 20–30% of cases of fertility problems. Current strategies to tackle infertility often come at a substantial financial cost and carry the risk of various enduring adverse effects. The causes of male infertility span a broad spectrum, encompassing both quantitative and qualitative declines in semen quality. What has consistently piqued the interest of both medical professionals and researchers is the utilisation of herbal remedies, which possess a firmly established scientific basis for combating infertility. This review is dedicated to exploring the medicinal plants that have been documented in ancient texts and have since garnered scientific validation. These plants have demonstrated their effectiveness in enhancing male reproductive health and are recommended for addressing male infertility.

Keywords: Male Infertility, Medicinal Plants, Herbal Remedies, Fertility Enhancement Reproductive Health, Sperm Quality, Hormonal Balance, Semen Quality, Oxidative Stress, Antioxidant Properties, Ayurvedic Herbs

Introduction

Male infertility is a multifaceted issue with significant clinical and societal implications, persistently challenging medical practitioners and researchers. According to the World Health Organization, It is defined as "the inability to achieve a clinical pregnancy after a year of consistent unprotected sexual activity", underscoring its relevance in the realm of reproductive health.[1] Semen quality, a well-recognised proxy for male fertility, offers critical insights into the underlying factors contributing to male infertility. Globally, accurate statistics on infertility are somewhat limited, but estimates suggest that approximately an estimated 60–80 million couples grapple with infertility,[2] with male factors accounting for roughly 23% of cases in Indian couples seeking treatment[3]. Recent assessments in India suggest that approximately half of infertility cases can be attributed to male-related reproductive issues.[4] The frequency of primary infertility varies greatly across the globe, which is about 3.9% to 16.8%, according to the WHO.[5] In India, this diversity extends across states and social groups, with rates ranging from 3.7% to 15%.[5]

There is little information on diminishing sperm count in Indian men, despite minimum sperm and sperm quality function in healthy males having been described. A 13-year study in South India reported a 30.31% decrease in sperm count, along with reductions of 22.92% in motility and 51.25% in sperm morphology.[6] According to medical professionals from the AIMS, New Delhi, between 12 and 18 million Indian partners receive an infertility diagnosis each year. Environmental heat exposure, particularly in workplaces with elevated temperatures, has been linked to an increased incidence of infertility due to its adverse impact on sperm production. Over the past three decades, the sperm count

of the average Indian male has declined from 60.1 million/ml to around 20 million/ml, with both sperm motility and morphology showing decreases.[7]

Recently, a drop in semen quality has garnered attention due to habits like smoking, excessive alcohol use, and obesity, as well as exposure to chemicals and contaminants within the environment, all of which negatively impact fertility.[7] Hormonal imbalances, medication use, toxin exposure, and nutritional deficiencies all lead to male infertility. Sperm deterioration and male infertility are greatly impacted by oxidative damage, which is caused by an imbalance of reactive oxygen molecules (ROS) and antioxidants.[8–10]

The effectiveness of currently available fertility drugs may not be satisfactory due to numerous unwanted side effects. Conversely, higher success rates have been observed with intrauterine insemination (IUI), in vitro fertilisation (IVF), and assisted reproductive treatment (ART) as alternative treatments; they come at a significant cost and are associated with anticipated side effects.[11] Herbal interventions have gained prominence as a viable alternative, offering efficacy comparable to prescription drugs with fewer adverse effects. Numerous plants, including *Alpinia galangal, Withania somnifera, Ocimum sanctum, Zingiber officinale, Mucuna pruriens,* black pepper, *Butea superba, Eurycoma longifolia, Tribulus terrestris, Cynomorium coccineum, Chlorophytum borivilianum, and Epimedium koreanum* Nakai, have demonstrated fertility-enhancing properties.

In this review, we delve into the potential of these medicinal herbs, exploring their mec hanisms of action and clinical evidence, offering hope for individuals and couples grappling with sterility.

Aetiology of Infertility in Males

Infertility in men is a complex condition that can arise from a variety of factors, ranging from biological and genetic to lifestyle and environmental influences. In this section, we will delve into the common causes of male infertility, emphasising the multifactorial nature of this condition.[12]

Sperm Anomalies

Anomalies in sperm are a primary contributor to male infertility. These anomalies can manifest in several ways, including:

- **Low Sperm Count (Oligospermia):** Oligospermia refers to a reduced sperm count in the ejaculate. It is a prevalent condition and can significantly hinder the chances of fertilisation.
- **Poor Sperm Mobility:** Sperm motility is essential for sperm to reach and enter the egg, and reduced motility can make it more difficult for sperm to successfully cross the female reproductive system.
- **Abnormal Sperm Morphology (Teratospermia):** Sperm with abnormal shapes may have difficulty penetrating the egg. This can lead to fertilisation failure.
- **Azoospermia:** It is the medical term for the lack of sperms per ejaculation. It can be classified as obstructive (due to blockages in the reproductive tract) or non-obstructive (related to problems in sperm production).

Hormonal Imbalances

Hormonal imbalances can disrupt the delicate endocrine system that regulates reproductive functions. These imbalances may include:

- **Testosterone Deficiency:** Low levels of testosterone can affect sperm production and overall reproductive health.
- **Pituitary and Hypothalamic Disorders:** Dysfunction in the pituitary gland or hypothalamus can lead to imbalances in the hormones that regulate sperm production.

Lifestyle Factors

Lifestyle choices and habits have a considerable role in male fertility. Common lifestyle factors associated with male infertility include:

- **Smoking:** Smoking tobacco is linked to reduced sperm count, mobility, and DNA damage in sperm.
- **Alcohol Consumption:** Excessive alcohol consumption can disrupt hormonal balance and impair sperm production.
- **Drug Use:** The use of recreational drugs, such as marijuana and cocaine, can negatively affect sperm quality and fertility.
- **Obesity:** Being overweight or obese is associated with hormonal imbalances and can contribute to infertility.
- **Stress:** Chronic stress can lead to hormonal changes that affect sperm production and function.

Environmental Factors

Environmental factors can also play an essential role in male infertility. Certain contaminants and pollutants, such as industrial chemicals, pesticides, and heavy metals, can damage sperm and reduce fertility.

Genetic Factors

Genetic factors can influence male infertility. Impaired sperm production can result from some genetic disorders, including Klinefelter syndrome and Y-chromosome microdeletions.

Inflammation and Infections

Sexually transmitted diseases (STIs), which include reproductive tract infections, can result in inflammation.

- **Varicocele:** The expansion of scrotal veins is known as a varicocele. It may increase testicular temperature, reducing the amount along with the quality of sperm produced.

ISSN: 2278-2044
DOI: https://doi.org/10.24321/2278.2044.202450

- **Structural Abnormalities:** Male reproductive tract structural defects, whether congenital or acquired, can hinder the passage of sperm during ejaculation.
- **Medications and Medical Treatments:** Certain medications, such as those used in cancer treatments, can have detrimental effects on sperm production. Additionally, some medical treatments, like radiation therapy, may damage the testicles and impair fertility.[13–16]

In summary, male infertility is a multifaceted issue with a wide range of causes.

It often results from a combination of factors, making diagnosis and treatment complex. Understanding these common causes is essential for both healthcare providers and individuals seeking to address male infertility effectively. A comprehensive evaluation is typically required to identify the specific factors contributing to infertility in each case, allowing for personalised treatment approaches.

Herbs for Enhancing Male Fertility

For countless centuries, therapeutic herbs have played a pivotal role in the healthcare practices of diverse cultures worldwide. Traditional Indian medicine, which has evolved over the ages, has consistently intrigued medical practitioners and researchers due to its well-documented and scientifically substantiated therapeutic applications, offering hope to those struggling with male infertility. Ancient literature from indigenous medical systems has chronicled the use of plant-based preparations for regulating fertility. As ongoing research continues to unveil their potential, medicinal herbs hold the promise of complementing conventional treatments and providing natural solutions for male infertility.

There are various herbs, which have been the subject of scientific investigation and have been reported to possess fertility-enhancing properties.[17] They are known to positively influence sperm quality, quantity, and hormonal levels, while also exerting influence over various aspects of reproductive function. The following list includes common herbs that have been scientifically examined and found to have fertility-enhancing effects by influencing many elements of reproductive functioning and sperm quality, volume, and hormone levels.

Alpinia galanga (A. galanga)

Alpinia galanga is a perennial herb found in Asia, known for its medicinal use from its rhizomes and roots. It has spasmolytic, anti-inflammatory, and antibacterial properties.[18] It is often consumed as tea or tincture. It also contains a variety of flavones like galangin and alpinin, which are phenolic compounds rich in flavonoids and phenolic acids.[19–20] Studies have explored its antioxidant and anticancer potential, which can benefit fertility, especially in men, by protecting DNA and improving sperm quality. Thus, it is essential to consider how dietary and biochemical factors affect reproductive health and subfertility therapy. It has been determined that using A. galanga extract with ethanol dramatically enhanced sperm mobility survival and that this herb could potentially be useful for improving the characteristics of sperm.[21]

Withania somnifera (Indian Ginseng)

In Sanskrit language, the term “ashwagandha” translates to “the smell of a horse” due to a distinctive smell that is similar to that of horse poop. This name also draws a mythological parallel, comparing the plant’s potential to enhance male sexual vitality to that of a horse. Ashwagandha offers numerous beneficial properties for alleviating male reproductive issues, including stimulating spermatogenesis and enhancing circulation to reproductive organs and the endocrine system. It alleviates symptoms of enlarged prostate, nighttime emission, premature ejaculation, and spermatorrhea.

Studies have shown that *Withania somnifera* can counteract stress-related infertility in men and protect against endocrine disruptions in fertility induced by physical activity in rats.[22] By simulating the actions of testosterone and interstitial cell-stimulating hormone and triggering nitric oxide synthase, its aqueous extract demonstrated the ability to enhance spermatogenesis.[23] In contrast to a control group, patients with oligospermia who received Ashwagandha root extract showed a significant increase in circulating hormone levels and a rise in spermatogenesis.[24] By decreasing lipid peroxidation and protein carbonyl content, raising sperm count and motility, and restoring antioxidant enzyme levels in seminal plasma, this herb successfully combats oxidative stress.

When infertile men with a normal sperm count were given Ashwagandha powder at a dosage of 5 grams per day for twelve weeks, it led to an immense decline in stress, improved antioxidant levels, greater sperm volume, elevated vitamin concentration such as A, E, and ascorbic acid, and normalised fructose levels. Several studies have also shown the herb’s impact on the hypothalamus and pituitary gland, boosting testosterone and luteinising hormone levels and dropping prolactin and FSH levels in subfertile males.[25–27]

Mucuna pruriens

This distinctive herb belongs to the family Fabaceae, which offers a taste that can range from sweet to slightly bitter and possesses a rich, dense, and oily quality. Its primary application lies in restoring balance to the vata and pitta doshas, as its excessive use tends to elevate kapha. Typical dosages for Kapikacchu range from 1.6 to 6 grams.[28] Alkaloids obtained from the seeds of *M. pruriens*

ISSN: 2278-2044
DOI: https://doi.org/10.24321/2278.2044.202450

have been shown to enhance spermiogenesis and testicular and accessory gland weight in male rats.[29] *M. pruriens* also increases sexual activity in these rats, resulting in higher mounting frequency, delayed ejaculation, and increased intromission frequency.[30,31]

M. pruriens demonstrated incredible efficacy in reversing spermatogenic toxicity caused by estradiol administration in male rats in a landmark study. This positive outcome results from the herb's ability to mitigate ROS (reactive oxygen species), regulate cell death, and boost germ cell numbers. The major constituent, L-DOPA, significantly attributes to *M. pruriens*' spermatogenic qualities.[32]

Moreover, the seed's extract has demonstrated substantial enhancements in sexual desire, sperm characteristics, endocrine levels, and sexual potency.[33] It also plays a role in regulating lipid levels, including lipids, triglycerides, cholesterol, and phospholipids, as well as vitamin A, E, and ascorbic acid. It significantly inhibits oxidative stress triggered by peroxidation in reproductive glands, while also restoring antioxidant levels in seminal plasma.[34,35] *M. pruriens* enhances levels of testosterone, LH, dopamine, adrenaline, and noradrenaline from a neuroendocrine perspective while decreasing FSH and prolactin levels in non-fertile men. *M. pruriens* has a positive influence on steroidogenesis and the quality of semen in infertile men.[36]

Asparagus racemosus

Shatavari possesses the potential to act as a potent tonic for men. This herb has a bittersweet taste and exerts a soothing and cleansing influence on the liver and blood. It focuses mostly on pitta dosha, especially in the small intestine. Its cooling qualities work in harmony with the warming effects of sperm-count-boosting herbs like garlic, onion, and ashwagandha. Shatavari hence aids in preventing sperm loss brought on by high pitta. It benefits the vata dosha because of its heavy and nourishing qualities, especially when combined with other hot *vajikarana* herbs like ashwagandha or *bala*. The plant can be used to make a milk decoction in amounts of 3 to 6 grams, taken alone or combined with other herbs.[37]

In situations where sexual desires are intertwined with emotional factors, Shatavari, when paired with a soothing herb like *brahmi* (gotu kola), may potentially boost desire and assist in managing distressing feelings like rage and aggressiveness. Consequently, Shatavari emerges as a valuable herb in Ayurvedic formulations aimed at harmonising pitta and vata in regulating male reproductive functions. It finds utility in addressing various conditions, including overall fatigue, decreased libido, rage, anxiety, irritability, inflammation, excessive acidity, urogenital infections, and burning sensations. The recommended standardised dosage ranges from 2000 to 6000 mg of powdered herb, taken 2 to 3 times daily. It's crucial to note that Shatavari must be avoided by people with respiratory or sinus congestion.[37]

Sida cordifolia

Bala, a term derived from Sanskrit meaning 'strength,' serves as a rejuvenating herb particularly beneficial for pitta and doshas. It plays a crucial role in nourishing and fortifying various bodily tissues, including muscles, plasma, marrow in the bone, and reproductive tissue. Having a sweet, thick, and a little bit oily nature, it can lead to kapha when excessively consumed and has mild cooling properties.

In Ayurveda, *bala* is recognised as one of the most effective anti-vata herbs, addressing both physical and mental imbalances. It holds a prominent place in Ayurvedic treatments for conditions like chronic fatigue (*balakshaya*), where it rejuvenates overall health, helping to combat exhaustion of physical and mental vitality. Furthermore, *bala* functions as a tonic that revitalises sexual potency, supports spermatogenesis and enhances male fertility.[37,38]

Bala can be consumed orally or utilised as a massaging oil, often combined with Ashwagandha, to enhance penile tone and prevent premature ejaculation. It also pairs well with other herbs like *gokshura, vidarikandha,* saw palmetto, and *kapikacchu* to promote reproductive health. The typical recommended dose of bala varies from 2 to 6 grams, taken 2 to 3 times daily.

Piper longum

The revitalising plant pippali has warming and invigorating properties, and it has a knack for reducing excess kapha. Its natural oiliness protects it from causing dryness, making it particularly beneficial for vata imbalances. Moreover, its post-absorption effect is pleasantly soothing for pitta, setting it apart from other hot spices and herbs. When used in conjunction with Ashwagandha, it promotes improved blood circulation to the reproductive structures.[39] Studies also showed a substantial rise in serum testosterone levels, epididymal sperm concentration, counts of spermatocytes and spermatids, and epididymal weight.

According to Ayurveda, Pippali has the ability to enhance vital life energy and purify the system through the breath. It aids in enhancing digestion, nutrient absorption, and overall assimilation, while also facilitating better respiration and offering relief from arthritic discomfort. The recommended dosage for this herb typically ranges from 1 to 3 partitions when included in complex formulations, or can vary from 250 mg to 1.51 grams. It's important to note that pippali must be restricted in cases of inflammation.

Butea superba Roxb

Butea superba Roxb, also known as the 'Red Kwao Krua,' has a longstanding reputation for its ability to enhance

ISSN: 2278-2044
DOI: https://doi.org/10.24321/2278.2044.202450

male sexual vitality. Its alcoholic extract has demonstrated significant benefits. Notably, it led to a marked elevation in the amount of spermatozoa and enhanced sperm mobility without causing any adverse impact on sperm or testicular health.[40]

Furthermore, when male rats were given a crude extract of this herb at varying doses over an 8-week period, it raised the weight of the testicles and the number of sperm.[41]

The ethanol extract of *Butea superba* also has the capacity to improve penile erection. It achieves this by acting through the cAMP/ cGMP pathways, which play crucial roles in the physiological processes associated with sexual function.[42]

Vidarikandha (*Ipomoea digitata*)

Vidarikandha, a starchy tuber, is well known for its ability to stimulate spermatogenesis. It acts swiftly when consumed as a milk decoction. Importantly, it is a milder option for individuals with a predominant kapha constitution compared to *shatamuli* and *bala.*

In association with *kapikacchu*, Vidarikandha is a valuable element in addressing enlarged prostate concerns. This herb, which boasts a sweet and cooling nature, supports the enhancement of ojas (vitality), muscle tone, motor coordination, and the ability to combat sexual impairment that is frequently brought on by anxiety and adrenal stress.

When combined with other herbs like ginseng, licorice, *gokshura*, and ashwagandha, Vidarikandha strikes a balance, offering benefits without being excessively warming or overly cooling. Its adaptability makes it highly valuable for balancing both vata and pitta imbalances. A standard dosage of Ipomea typically ranges from 2000 to 6000 mg, taken 2 to 3 times daily.[43]

Shilajit (Black Bitu men)

Shilajit holds immense significance in Ayurveda due to its remarkable properties. With its warming characteristics, it enhances virility and sexual endurance by addressing over kapha while keeping the genital tone normal. When there are reproductive problems related to kapha, Shilajit is often combined with Ashwagandha to bring about effective results. For those dealing with an enlarged prostate, combining Shilajit with herbs like hogweed, gokshuradi guggulu, Krakach Tal, ashwagandha, or *vidhari* can be used as an effective herbal remedy.[44]

Curculigo orchioides

Curculigo orchioides, also called Kali Musli, hails from the Amaryllidaceae family. It stands as a remarkable aphrodisiac and rejuvenating herb, contributing to improved sexual arousal and performance through various mechanisms, including the induction of penile erection, the sustenance of mating activity, and the influence on orientation behaviour.

Moreover, *Curculigo orchioides* exhibits notable anabolic and spermatogenic effects, leading to a rise in reproductive organ weight. In rat studies, this herb has demonstrated the ability to reduce mount latency, elevate the frequency of mounts, the erection of the penis and attract women.[45] In cases of sexual dysfunction stemming from physical or heat-related factors, *Curculigo orchioides* serves as a valuable agent in ameliorating reduced spermatogenesis and potentially mitigating disruptions associated with heat shock proteins.

Cynomorium coccineum

Cynomorium coccineum Linn., a member of the Cynomoraceae family, is a remarkable black, leafless parasitic plant that lacks chlorophyll, setting it apart from conventional green plants. Despite its unique characteristics, it holds a wealth of potential in the realm of reproductive health.

Research on this intriguing herb has revealed that its aqueous extract possesses the remarkable ability to induce significant improvements in several key parameters related to sperm health. Specifically, it has been observed to lead to a marked elevation in sperm count, viable spermatozoa, and enhanced sperm mobility. Moreover, the extract has demonstrated its potential to reduce the abnormalities, ultimately contributing to the enhancement of spermatogenesis.[46] This discovery sheds light on the valuable role that *Cynomorium coccineum* may play in addressing reproductive challenges and underscores its potential as a natural remedy to support and promote male fertility. Further exploration of this unique plant and its mechanisms of action holds promise for the field of reproductive medicine.[46]

Chlorophytum borivilianum

The plant *Chlorophytum borivilianum* also called Safed Musli and belonging to the Liliaceae family, is recognised for its potential as a potent aphrodisiac and sexual stimulant. Extracts derived from the ro ots of this herb, particularly the ethanolic extract and sapogenins isolated from the roots, have exhibited notable effects on male rats.

In studies conducted on male rats, the administration of these extracts has resulted in anabolic and spermatogenic effects. These effects are evident through a visible increase in the weight of the reproductive organs as well as an increase in body mass overall. Furthermore, the plant has shown the capacity to influence sexual behaviour in animals. This is manifested by a reduction in increased mount frequency, mount ejaculation, post-ejaculatory delay, and intromission lag, along with a stronger affinity for females.[47]

ISSN: 2278-2044
DOI: https://doi.org/10.24321/2278.2044.202450

Additionally, the extract of dried roots from this herb has been found to enhance sexual arousal, strength, libido, and sperm count in male rats.[48] Notably, the herb has also demonstrated its potential to improve male reproductive functions, even in diabetics.[49]

Epimedium koreanum

Epimedium, a plant from the Berberidaceae family, is a well-known herbal and botanical supplement from China known for its health-promoting properties. Various species of this herb, including E. *pubescens* Maxim, E. *koreanum* Nakai, and E. *brevicornum* Maxim, are used for medicinal purposes. Hydroalcoholic extracts of this herb have been extensively studied and are known for their aphrodisiac effects. They are often utilised to improve erectile performance.

The principal flavonoid present in Epimedium extracts is icaridin, which is also the most active component. Icariin is notable for its selective inhibition of phosphodiesterase-5 (PDE5), a mechanism that improves erectile function.[50] Furthermore, icariin has the capacity to boost spermatogenesis by mimicking the actions of testosterone.[51]

Eurycoma longifolia

It is commonly referred to as Tongkat Ali and hailing from the Simaroubaceae family, is a prominent aphrodisiac herb originating from Malaysia. Studies involving E. *longifolia* extract treatment have successfully induced sexual improvement in previously naive male rats.[52] It has been proven that this herb's ethanol extract improves the libido and vigour of male rats, especially by lengthening the time and frequency of copulation.[52]

These herbs collectively offer a promising array of natural remedies and potential treatments for various aspects of male reproductive health, from enhancing sexual function to improving spermatogenesis and libido. Further research into their mechanisms and applications holds considerable promise in the field of reproductive medicine.

Tribulus terrestris

Tribulus terrestris Linn., commonly known as devil's weed and belonging to the Zygophyllaceae family, is a continual creeping herb with a global presence. It has a rich history as an aphrodisiac and has been traditionally employed to address various health concerns, including inflammations, leucorrhoea, urinary infections, oedema, and ascites.[53]

Studies involving the administration of T. *terrestris* to animals have provided noteworthy insights into its potential benefits. It has been observed to enhance plasma testosterone levels, thereby inducing spermatogenesis.[4] Furthermore, this herb has demonstrated its ability to elevate sex hormones like testosterone and luteinising hormone,[55] along with increasing the activities of dehydroepiandrosterone, dihydrotestosterone, and dehydroepiandrosteronesulfate[56].

The corpus cavernosal tissues of New Zealand white rabbits were used in experiments in vitro after T. *terrestris* treatment revealed its proerectile properties. These effects have been substantiated through various pharmacological studies, apart from electrical field stimulation, establishing its potential as a proerectile agent.[57] Moreover, T. terrestris has shown the capacity to enhance sexual behaviour, as evidenced by an increased mount frequency, penile erection index, and overall sexual performance and intromission delay. It's also linked to an increase in prostatic weight and intracavernosal pressure.[56]

Citrullus vulgaris (Watermelon)

Watermelon, scientifically known as *Citrullus vulgaris* and belonging to the Cucurbitaceae family, is a fruit that is not only refreshingly delicious but also harbours a surprising potential to influence male reproductive health positively. The seeds of this fruit, often discarded, contain compounds that have been found to have noteworthy impacts on sperm health and fertility.[58]

Research has shown that the consumption of watermelon seeds can lead to an increase in sperm concentrations. This means that men who incorporate these seeds into their diet may experience a higher number of sperm cells in their ejaculate, which is a crucial factor in fertility. Moreover, watermelon seeds have been found to enhance sperm motility. Motility implies the ability of sperm cells to move activeely and effectively towards their destination, which is the female egg during fertilisation. Improved motility means that a higher percentage of sperm are capable of reaching and penetrating the egg, thereby increasing the chances of successful fertilisation.

In addition to boosting sperm concentrations and motility, watermelon seeds have also been associated with improved sperm viability. Sperm viability indicates the percentage of sperm that are alive and healthy. Enhanced viability means that a greater proportion of sperm possess the necessary vitality to successfully fertilise an egg.

Zingiber officinale (Ginger)

Ginger, botanically known as *Zingiber officinale* and belonging to the Zingiberaceae family, is a well-known and widely used spice and medicinal herb. While it's renowned for its culinary and therapeutic properties, ginger has also garnered attention for its potential positive effects on male reproductive health, particularly in enhancing sperm-related parameters.[59]

Studies have indicated that ginger consumption can lead to a considerable elevation in spermatozoa. Sperm count is a critical factor in male fertility, as it directly impacts

ISSN: 2278-2044
DOI: https://doi.org/10.24321/2278.2044.202450

the chances of fertilising an egg. By boosting sperm count, ginger may contribute to higher fertility rates among men. Furthermore, ginger has been associated with an improvement in sperm mobility, which refers to the vigorous swimming ability of spermatozoa, which is essential for reaching and penetrating the female egg during fertilisation. Enhanced motility means a higher percentage of sperm are capable of effectively navigating the female reproductive tract. Ginger also appears to positively influence sperm vitality. In addition to these sperm-related benefits, ginger has been linked to an increase in testicular mass. The testes are responsible for sperm production, and any positive changes in testicular mass can potentially lead to higher sperm production, thus contributing to overall reproductive health.[60]

Mechanism of Action

The curative mechanism of herbal remedies in the management of male infertility is a complex interplay of various biochemical, physiological, and hormonal processes. Different herbs may have distinct mechanisms of action, but generally, they target multiple aspects of male reproductive health to improve fertility. Here, we outline some common mechanisms of action associated with medicinal herbs in male infertility:

Hormone Regulation

Many medicinal herbs influence hormonal balance, particularly the regulation of tropic hormones from the anterior pituitary gland and male sex hormone. Proper hormonal balance is essential for spermatogenesis (sperm production) and overall reproductive health.

Antioxidant Effects

Spermatozoa can be harmed by oxidative stress, which is characterised by an imbalance between reactive oxygen species (ROS) and antioxidants. Medicinal herbs often possess antioxidant properties that help reduce oxidative stress, protecting sperm from oxidative damage.

Improved Sperm Quality

Medicinal herbs may enhance spermiogram involving sperm count, morphology, and motility of sperm. This can lead to a rise in the number of healthy, mobile sperm available for fertilisation.

Reduction of Stress

Stress, both physical and psychological, can negatively impact male fertility. Some herbs act as adaptogens, helping the body adapt to and cope with stress. This can indirectly improve fertility by reducing stress-related factors.

Anti-Inflammatory Effects

Chronic inflammation in the reproductive organs can impair sperm production and function. Medicinal herbs with anti-inflammatory properties can alleviate inflammation and promote better reproductive health.

Enhanced Blood Flow

Proper blood flow to the genitals is crucial for optimal sexual function and fertility. Some herbs improve circulation, ensuring that the reproductive organs receive an adequate supply of oxygen and nutrients.

Neurotransmitter Regulation

Some herbs contain precursors to dopamine. Dopamine is a neurotransmitter associated with pleasure and reward, and it can positively influence sexual desire and function.

Hormone Receptor Modulation

Certain herbs may interact with hormone receptors in the body, influencing the sensitivity of these receptors to hormones like testosterone. This can lead to more efficient utilisation of available hormones for reproductive purposes.

Detoxification

Herbs may support the body's natural detoxification processes, helping to eliminate harmful toxins and pollutants that can impair sperm quality and function.

Prostate Health

Herbs like saw palmetto can promote prostate health, which is vital for proper sperm production and seminal fluid production.

It is important to note that the specific mechanisms of action can vary from one herb to another, and the effectiveness of these herbs may depend on individual factors. Additionally, while some herbs have demonstrated promise in improving male fertility in both traditional and modern medicine, more research is essential to fully comprehend their mechanisms and optimise their use as complementary treatments for male infertility. Consultation with a healthcare professional or herbalist is advisable before using medicinal herbs for fertility concerns to ensure safety and efficacy.

Conclusion

Throughout diverse cultures, a vast array of herbs have found utility in addressing issues of male infertility. Herbal medicine offers a superior approach to rejuvenating and nourishing reproductive organs, thereby enhancing their quality and quantity. Some herbs exhibit the dual capacity of both stimulating and nurturing.

Given the complexities and high costs associated with modern treatments for male infertility, herbal remedies are experiencing a resurgence in acceptance. They have sustained implications for male reproductive health by augmenting sexual performance, enhancing vigour, regulating neuroendocrine functions, and fortifying the structural and functional aspects of reproductive organs.

ISSN: 2278-2044
DOI: https://doi.org/10.24321/2278.2044.202450

Additionally, these herbal interventions contribute to improvements in semen quality, sperm morphology, and motility.

In the realm of medical research, there is an urgent need to delve deeper into the concealed mechanisms by which various herbs can counteract male infertility. This issue looms as a significant threat to future generations, emphasising the imperative for further exploration and comprehension.

Source of Funding: None

Conflict of Interest: None

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ISSN: 2278-2044
DOI: https://doi.org/10.24321/2278.2044.202450