

An ethnobotanical survey of medicinal plants used for primary male infertility in Vijayapur district, Karnataka, India

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Abstract

An ethnobotanical survey of Vijayapur district, comprising five tehsils, was conducted from February 2018 to September 2025. The main purpose of this survey was to document the traditional use of medicinal plants for male primary infertility in the Vijayapur district. A total of 15 species belonging to 15 genera and 12 families were found to be used to treat primary male infertility. Interviews were conducted among indigenous people, and practical knowledge of treating male infertility using local plants were documented. Male infertility, which affects 20–30% of infertility cases, is influenced by systemic diseases, hormonal imbalances, and lifestyle choices. Traditional medical practices in India, particularly in the Vijayapur district, utilize approximately 15 medicinal plant species to enhance sperm count and motility, including members of the Solanaceae family, including various herbal remedies prepared as decoctions and juices. Notable plants such as *Aegle marmelos* (L.) Corrêa and *Mucuna pruriens* (L.) DC. have shown potential benefits, and *M. pruriens* shown to improve sperm parameters in stressed infertile men. Other plant species, such as *Myristica fragrance* Houtt. and *Withania somnifera* (L.) Dunal., also contribute positively to reproductive health. The research highlights the need for further studies on local medicinal plants used for male infertility in the region.

Keywords: Ethnobotany, Fertility, Indigenous knowledge, Treatments

1. Introduction

Male infertility is responsible for about 20–30% of infertility cases and contributes to nearly half of all infertility problems in couples. Traditional medical systems such as Ayurveda, Unani, Siddha and various tribal practices widely use medicinal plants to improve sperm count, motility, testosterone levels and reproductive health. These plants often possess antioxidant androgenic, spermatogenic and aphrodisiac properties that support male fertility (Roozbeh *et al.*, 2021). India has been recognized as one of the world's leading hubs for traditional herbal knowledge and the diversity of medicinal plants. Numerous medicinal herbs have originated, been domesticated and are being conserved due to the nation's diverse agroclimatic conditions, abundant forest ecosystems and long history of traditional medical systems like Ayurveda, Siddha, Unani and folk medicine. According to recent research, India has between 7,000 and 7,500 kinds of medicinal plants that are utilized in various

native medical systems (Aggarwal *et al.*, 2024). Herbal treatments may considerably increase semen volume, sperm concentration, total sperm count, sperm motility and normal sperm morphology, according to studies and meta-analyses. Among the most explored herbs for male reproductive health are *Withania somnifera* (L.) Dunal., *Mucuna pruriens* (L.) DC, *Panax ginseng* L., *Nigella sativa* L., and *Tribulus terrestris* L. (Shahid *et al.*, 2022).

Primary male infertility refers to a condition in which a man has never fathered a pregnancy despite at least 12 months of regular unprotected sexual intercourse with a fertile partner (World Health Organization, 2010). Many men are experiencing primary infertility as a result of occupational factors, stress, delayed marriage and exposure to dietary and environmental chemicals. Male infertility can result from a number of factors, including systemic disease (Mahmoud and Comhaire, 2006), spermatogenic defect (Yan, 2009), microbial infections (Emokpae *et al.*,

2009), immunological disorders (Hinting *et al.*, 1996), endocrine disruptors (Rehman *et al.*, 2018), hormonal imbalance (Khourdaji *et al.*, 2018), genetic anomaly (Plaseska-Karanfilska *et al.*, 2012), environmental pollutants and lifestyle (Durairajanayagam, 2018) such as steroids use, smoking, alcohol consumption, obesity, tight clothing and prolonged exposure to mobile phone radiations as well as drug-related factors. The World Health Organization (2010) states that a sperm count of 15 million or more per milliliter (mL) of semen is considered normal. Additionally, a total count of at least 39 million per ejaculate is regarded as typical. A total lack of sperm is called azoospermia, whereas oligospermia, which is defined as a count of less than 15 million per milliliter, can make conception more challenging (Chawre *et al.*, 2024).

Maintaining a healthy weight, eating a diet full of fruits and vegetables, avoiding smoking and excessive alcohol, managing stress and avoiding some environmental toxins are all ways to increase fertility (Sharma *et al.*, 2013; Durairajangam, 2018). Many men avoid seeking medical consultation due to the high cost of medications and diagnostic procedures. Herbal remedies are readily available and reasonably priced (Azaizah *et al.*, 2003; Bodeker, 2005; World Health Organization, 2025). The present study was initiated to identify medicinal plant resources from Vijayapur district traditional practitioners to treat male primary infertility.

2. Materials and methods

Vijayapur district, Karnataka, India, is located between latitudes 16° 01' - 17° 45' N and longitudes 75° 03' - 76° 29' E (Fig. 1). It borders Belgaum, Bagalkot, Raichur, Gulbarga and the Sholapur district of Maharashtra. The district covers an area of 10,541 square kilometers and features a Deccan plateau landscape with a height ranging from 365 to 610 meters above sea level. The region experiences an arid, tropical and steppe climate with temperatures varying from 15°C in winter to 42°C in summer. Notable rivers include the Doni, Krishna and Bheema.

Field surveys covered 15 villages across five tehsils, Vijayapur, Muddebihal, Sindagi, Basavanbagevaadi and Indi of Vijayapur district. Interviews were held with 17 herbal healers (16 men and 1 woman), aged 48 to 84, using a standard questionnaire to collect data on medicinal plants, including scientific name, family, local name, habit, part used, ailment and mode of administration. Medicinal species were photographed and identification relied on expert consultation and references, including the Flora of Gulbarga District (Seetharam *et al.*, 2000) and the Flora of the Presidency of Madras (Gamble, 1928). Voucher specimens were preserved at the herbarium center at the Department of Botany, Karnataka State Akkamahadevi Women's University, Vijayapura.

3. Results and discussion

The present study documents 15 species of angiosperms belonging to 15 genera and 12 families. The predominant



Fig. 1. Study area

family is Solanaceae, with two species. Herbal preparations used for the treatment of primary infertility are decoctions, juices and pastes. Other substances like honey, cow milk, safflower oil and cow ghee are also used in various preparations. All documented plant species are arranged alphabetically and details including scientific name, family, vernacular name, habit, part used and mode of administration are provided in Table 1.

Various plant parts are used in the treatment of primary infertility, including roots (40%), stems (20%), seeds (20%), fruits (13.3%) and underground stems (6.7%) (Fig. 2). Previous studies have documented medicinal plants from various districts of Karnataka. However, there is limited or no specific information available on plants used for primary male infertility in Vijayapur district. A review of related literature reveals that medicinal plants used by the traditional practitioners of this region are not commonly reported for the same purpose in other regions (Shukla *et al.*, 2008; Tripathi *et al.*, 2010). However, these plants were used for other human ailments. For instance, leaves of *Tribulus terrestris* L. are used to expel stones (Ghatapanadi *et al.*, 2011). Leaves of *Tridax procumbens* L. are used for hemorrhage, leaves of *Albizia lebbek* (L.) Benth. are used for snake bites and leaves of *A. marmelos* are used to expel kidney stones in Andhra Pradesh (Madhu and Naik, 2009). Leaves and twigs of *Guilandina bonduc* L. are traditionally used for the treatment of tumors, inflammation, liver disorder, toothache, elephantiasis and smallpox (Khan and Khan, 2012).

Relevant recent studies have been reviewed and cited to support the ethnobotanical findings. To shed light on the provided scientific background basis, *A. marmelos* mixes are widely used by traditional healers in various parts of India for the treatment of infertility-related disorders and control the regulation of reproductive processes.

The plant has bioactive substances that affect hormone

Table 1. Medicinal plants used to treat primary infertility in male by traditional practioners of Vijayapur district (Plate 1)

Sl. No.	Scientific name	Herbarium/Voucher specimen numbers	Family	Vernacular name	Habit	Part(s) used	Ailment	*Mode of administration
1	<i>Abrus precatorius</i> L.	HKSAWUVA22260	Fabaceae	<i>Gulaganji</i>	Climber	Root	Enhancement of sperm count	Root boiled in milk with added sugar is taken orally.
2	<i>Achyranthus aspera</i> L.	HKSAWUVA24	Amaranthaceae	<i>Utharani</i>	Herb	Root	Maleinfertility	Pinch of root ash mixed with honey, taken orally.
3	<i>Aegle marmelos</i> (L.) Corrêa	HKSAWUVA22262	Rutaceae	<i>Bilva patre</i>	Tree	Fruit pulp	Gerneral weakness	Half a spoon of dried fruit pulp powder mixed with one glass of milk, taken daily.
4	<i>Guilandina bonduc</i> L.	HKSAWUVA22241	Fabaceae	<i>Shirasal gida, Gaalimara</i>	Tree	Stem bark and Leaves	Male infertility	200 g of bark and 100 g of young leaves are ground and boiled in 1000 mL of water until reduced to 500 mL. The filtered decoction is taken with honey once daily on an empty stomach in the morning for 25 days.
5	<i>Alium cepa</i> L.	HKSAWUVA22264	Liliaceae	<i>Ullagaddi</i>	Herb	Underground stem	Male infertility	20 mL of white onion juice mixed with ghee, carom seeds and rock sugar; taken once daily for 20 days.
6	<i>Butea monosperma</i> (Lam.) Taub.	HKSAWUVA22514	Fabaceae	<i>Muthuga</i>	Climber	root	Male infertility	<i>Butea</i> root ashes eaten with beetle leaf. Preparation: a handful of roots cut into pieces, put in mud pot and made into a small hole. Keep another mud pot below. Burn charcoal above the first pot. Ashes will be collected below the pot.
7	<i>Diplocyclos palmatus</i> (L.) C. Jeffrey	HKSAWUVA433	Cucurbitaceae	<i>Shivalinga beeta</i>	Climber	seeds	General weakness	Dried seeds boil in sesam oil. Stored in a glass bottle. Apply daily on veins (on the body).
8	<i>Phyllanthus emblica</i> L.	HKSAWUVA22263	Euphorbiaceae	<i>Nelligida</i>	Tree	Fruit	Male infertility	Fruit juice with ghee taken for 15 days.
9	<i>Mesosphaerum suaveolens</i> (L.) Kuntze	HKSAWUVA22630	Lamiaceae	<i>Beeja bandha</i>	Under shrub	Seeds	Male infertility	50 gm seeds with 50 gm Talimkhan and Seeds of <i>Mucuna</i> , 50 gm, are powdered and administered to take 2 spoonfuls for 1 month.
10	<i>Mucuna pruriens</i> (L.) DC.	HKSAWUVA22632	Fabaceae	<i>Nasagunni</i>	Climber	Seeds	Enhancement of sperm count	Seed powder, half a spoon, taken orally per week.
11	<i>Myristica fragrance</i> Houtt.	HKSAWUVA222634	Myristicaceae	<i>Jaajikaayi</i>	Tree	Fruit	Male infertility	Pinch of fruit powder mix in water, take orally 45 days early in the morning.
12	<i>Phyllanthus reticulatus</i> Poir.	HKSAWUVA22482	Phyllanthaceae	<i>Nelanella</i>	Herb	Root	General Weakness	Boil the root in a glass of water and then suggest drinking it.
13	<i>Tricholepis glaberrima</i> DC.	-	Asteraceae	<i>Brahmadandi</i>	Herb	Root	Gerneral Weakness	10 ml root juice taken orally. afterwards drink 1 glass butter milk.
14	<i>Withania somnifera</i> (L.) Dunal.	HKSAWUVA1723	Solanaceae	<i>Ashwagandha</i>	Shrub	Root	Enhancement of sperm count	Powdered root mix with honey and ghee.
15	<i>Zingiber officinale</i> Roscoe.	HKSAWUVA22633	Zingiberaceae	<i>Shunti/alla</i>	Herb	Rhizome	Testicular swelling	Ginger juice with honey drink for 4 days.
							Enhancement of sperm count	Powdered rhizome boiled in ghee add jaggary again boil add water. Store it. Eat once in a day for 4 days, early in the morning in empty stomach.

*All the informations were documented by interview with local traditional practioners orally so if anyone use these plants for the treatments before consult the professional practioner first



Plate 1. (a). *Abrus precatorius* L.; (b). *Achyranthus aspera* L.; (c). *Aegle marmelos* (L.) Corrêa; (d). *Albizia lebbeck* (L.) Benth; (e). *Diplocyclos palmatus* (L.) C.Jeffrey; (f). *Mesosphaerum suaveolens* (L.) Kuntze; (g). *Tricholepis glaberrima* DC.; (h). *Withania somnifera* (L.) Dunal.; (i). *Zingiber officinale* Roscoe.

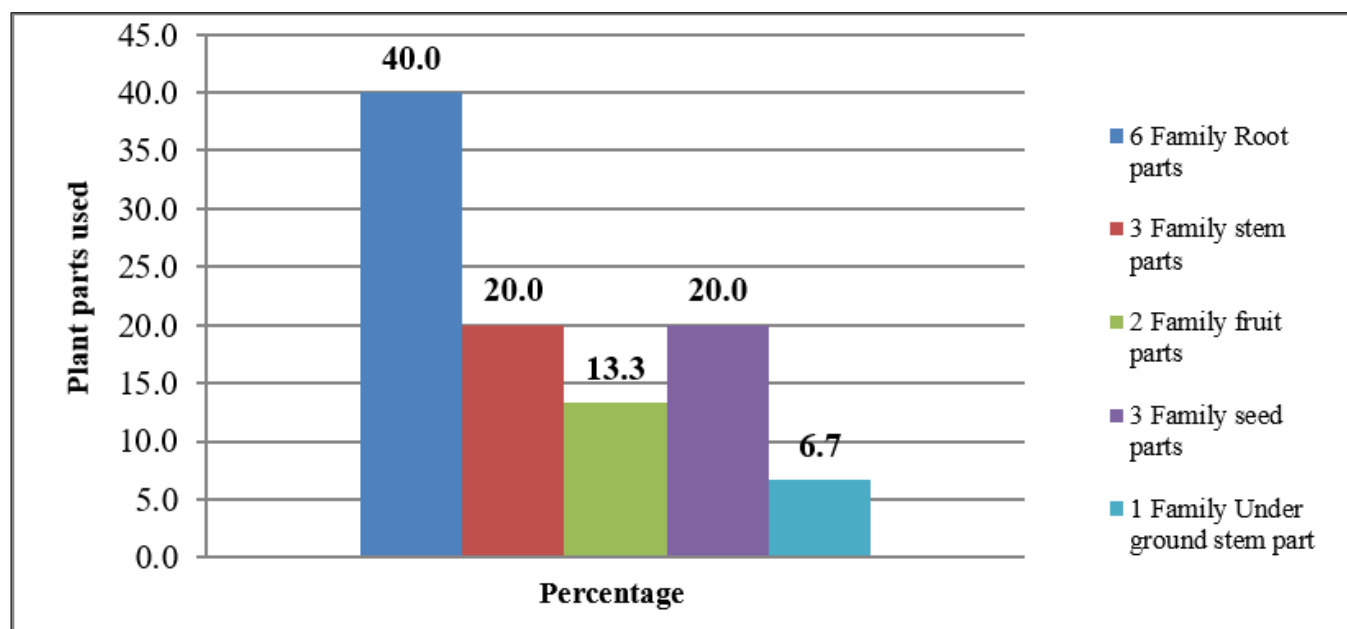


Fig. 2. Distribution of plant parts used for the treatment of primary male infertility documented

balance and reproductive physiology, including sterols, fagarine, aegeline, coumarins and flavonoids. These phytochemicals may have a pharmacological impact on male reproductive health by influencing spermatogenesis and reproductive hormone levels (Kawra *et al.*, 2022). Experimental studies have demonstrated that extracts of *A. marmelos* can influence male reproductive physiology. Administration of leaf or bark extracts in experimental animals resulted in decreased sperm count, motility and viability, reduced serum testosterone and histological alterations in testicular tissue affecting spermatogenesis. Fertility in male rats was suppressed in a dose-dependent manner, indicating the presence of substances capable of altering reproductive function (Agrawal *et al.*, 2012).

Albizia lebbek (L.) Benth. formulations can be utilized in traditional herbal medicine to treat male reproductive illnesses, such as infertility, diminished sexual vigor and other issues related to reproductive health. Many plant parts, including bark, roots, seeds, flowers and pods, are used either alone or in conjunction with other therapeutic plants in Ayurvedic and ethnomedical systems to treat reproductive disorders (Waseem *et al.*, 2020). To manage the reproductive health, folk practitioners prepare powders or decoctions from bark, pods, or flowers and take it orally for several days or weeks. In particular, the blossoms have long been used to treat sexual weakness and spermatorrhea, conditions commonly associated with male infertility (Gupta *et al.*, 2005). The weights of the testis, seminal vesicles, epididymis and ventral prostate were significantly reduced following treatment with *A. lebbek* pod extract. Sperm density and motility were also considerably decreased. The number of spermatids, secondary spermatocytes and primary spermatocytes was significantly decreased. Both the number of Sertoli cells and their cross-sectional surface area were significantly reduced. Additionally, the nuclear area and number of mature

Leydig cells were considerably reduced.

According to Gupta *et al.* (2004), significant reductions were observed in protein, glycogen and cholesterol levels in the testis, fructose level in the seminal vesicles and protein content in the epididymis. Onions promote luteinizing hormone production, neutralize the harmful effects of free radicals, primarily in the testes, enhance the antioxidant defense mechanism (such as glutathione and antioxidant enzymes) in the testis, improve insulin resistance, increase nitric oxide production in Leydig cells and change the activity of 5' AMP-activated protein kinase (Banihani, 2019). According to Chae *et al.* (2017), onion peel extract in rats, organophosphate esters (OPE) increases channel gating via protein kinase C (PKC) in the human embryonic kidney cell line HEK293, causing human Hv1-Hv1 channel potentiation. The study speculates that the positive impact of OPE on sperm motility stems from this mechanism. These findings may therefore result in the creation of medications that effectively target the Hv1 channel and may be applied to the treatment of male infertility. According to Deshmukh and Bhaga (2015), methanolic extract of *Butea monosperma* (Lam.) Taub. at a dose of 300 mg is not toxic and is highly significant ($p < 0.001$) for reproductive and vital organs, sperm count and testosterone, with the exception of the liver. Therefore, we can conclude that male albino rats, *Rattus rattus* (Wistar), have better reproductive function when exposed to the flower of *B. monosperma*. Additionally, *Diplocyclos palmatus* has antipyretic, anti-diabetic, anti-hyperlipidemic, antioxidant, spermatogenic, aphrodisiac, fertility booster and uterine tonic qualities (Magdalita *et al.*, 1990; Tripathi *et al.*, 2012). Due to overuse by humans for medicinal purposes and other purposes, this plant is currently regarded as an endangered species. Pregnant rats were used to test the anti-fertility effects of petroleum ether, alcohol and aqueous extracts of *Mesosphaerum suaveolens* (L.)

Kuntze. At 150 mg/kg and 125 mg/kg, respectively, the alcoholic extracts of *M. suaveolens*. (leaves) demonstrated 100% anti-fertility activity. The stage of gestation at which *M. suaveolens* is most effective continues to be studied (Garg, 1976).

Significant levels of copper, iron, magnesium and zinc are found in *M. pruriens* seeds. These components are crucial cofactors for numerous metalloenzymes and serve in spermatogenesis (Abou-Sakra *et al.*, 1989). Because of their biological antioxidant qualities, the amounts of vitamins A, C and E found in *M. pruriens* function as detoxifying agents, immunopotentiators and immune activators, improving sperm concentration and motility and reducing the amount of lipid peroxide in the seminal plasma of infertile men (Ames *et al.*, 1993). The study focuses on the way *M. pruriens* affects mentally stressed infertile men. The study investigated sperm parameters and biochemical markers before and after a three-month treatment with *M. pruriens* in 60 patients who were selected by questionnaires and increased serum cortisol levels. The findings showed that psychological stress increased cortisol and lipid peroxide levels, lowered antioxidant indicators and decreased sperm count and motility. *M. pruriens* dramatically improved sperm parameters and restored antioxidant levels after therapy, indicating its potential to increase semen quality and help infertile men manage stress (Shukla *et al.*, 2008).

All of the infertile research teams experienced an increase in sperm concentration and motility following treatment with *M. pruriens*. While asthenozoospermic men's sperm motility did not return to normal, oligozoospermic individuals saw a considerable recovery in sperm concentration. Additionally, following a reduction in lipid peroxides during therapy, the levels of lipids, antioxidant vitamins and rectified fructose were restored in the seminal plasma of all the infertile groups. According to Ahmad *et al.* (2008), the study was intended to open up new possibilities for the potential use of *M. pruriens* seed powder as a revitalizing and restorative agent for infertile males. According to Tajuddin *et al.* (2005), giving male rats an oral dose of 500 mg/kg of *M. fragrans* extract significantly increased their sexual activity. It resulted in a considerable decrease in the mounting latency and post-ejaculatory interval and a significant rise in the mounting frequency, intromission frequency and intromission latency. Additionally, it greatly enhanced the aggregation of penile reflexes with penile stimulation, erections, quick flips, long flips and mounting frequency with penile anesthesia. Additionally, the extract was found to have no negative effects or acute toxicity. The Maldhari community demonstrated a strong dependence on *P. reticulatus* for a variety of uses, highlighting its vital part in customary medical procedures. According to Sindhav *et al.* (2024), they used the dried root bark to promote fertility. *T. glaberrima* may be regarded as a restorative expert for gratifying male infertility. In normal rodents, it can improve sexual motility and promote spermatogenesis by

enhancing seminiferous epithelium proliferation. It was said that the herb *T. glaberrima* belongs to the category of aphrodisiacs, which increase *T. glaberrima* adaptability to sexual desire and those that enhance and stimulate the production of semen (Chittam and Deore, 2012). The study showed that *W. somnifera* influence on multiple metabolic, enzymatic and hormonal pathways may help treat the complex condition of infertility. According to Gupta *et al.* (2013), *W. somnifera* has been proposed as an alternative empirical therapy for the therapeutic management and treatment of male infertility. Ginger supplementation has been linked to improved reproductive health in rats co-administered with acephate by maintaining testosterone bioavailability and enhancing reproductive organ weights, spermatogenesis and sperm maturation. It is noted to positively affect sperm characteristics such as count, viability, mobility, morphology and DNA integrity. Ginger possess both androgenic activity and antioxidant properties, which contribute to better semen quality by reducing oxidative stress and modulating gonadotropin and sex hormone levels. Additionally, *Z. officinale* is traditionally used to treat male infertility and regulate the female menstrual cycle. Recent studies indicate that ginger extract can mitigate busulfan-induced testicular injury, with treated groups showing increased seminiferous tubule volumes and elevated sperm counts and testosterone levels.

4. Conclusion

The local ethnic communities of Vijayapura district possess significant uncovered traditional knowledge regarding the treatment of male infertility. Much of the data documented during the study period correlates well with modern medicinal knowledge fields. For instance, *Withania somnifera* (L.) Dunal is a common regional plant, serves as a potent traditional remedy for enhancing sperm count and sexual health, supported by modern clinical studies. The plant species documented in this survey align closely with existing pharmacological studies by various researchers. However, most of these species grow naturally without any formal conservation effort, even as Vijayapura undergoes rapid urbanization. Therefore, this studies highlights the urgent need of conservation to preserve thesespecies for both traditional and modern medical applications. Furthermore, due to the lack of clinical trials validating these traditional knowledge, rigorous studies are essential to confirm their safety and efficacy of these herbal remedies.

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Data Availability Statement (DAS): This information is collected from local traditional practitioners the author unable to disclose the name, its shop, etc.

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References

- Abou-Sakra, F.R., Ward, N.I. and Everard, D.M. 1989. The role of trace elements in male infertility. *Fertility and Sterility*. 52: 307–310. [https://doi.org/10.1016/S0015-0282\(16\)60860-9](https://doi.org/10.1016/S0015-0282(16)60860-9).
- Aggarwal, G., Sharma, M., Singh, R. and Sharma, U. 2024. Ethnopharmacologically important highly subsidized Indian medicinal plants: Systematic review on their traditional uses, phytochemistry, pharmacology, quality control, conservation status and future prospective. *Journal of Ethnopharmacology*. 320: 117385. <https://doi.org/10.1016/j.jep.2023.117385>.
- Agrawal, S.S., Kumar, A. and Gullaiya, S. 2012. Antifertility activity of methanolic bark extract of *Aegle marmelos* (L.) in male Wistar rats. *DARU Journal of Pharmaceutical Sciences*. 20: 94. <https://doi.org/10.1186/2008-2231-20-94>.
- Ahmad, M.K., Mahdi, A.A., Shukla, K.K., Islam, N., Jaiswar, S.P. and Ahmad, S. 2008. Effect of *Mucuna pruriens* on semen profile and biochemical parameters in seminal plasma of infertile men. *Fertility and Sterility*. 90(3):627–635. <https://doi.org/10.1016/j.fertnstert.2007.07.1314>.
- Ames, B.N., Shigenaga, M.K. and Hagen, T.M. 1993. Oxidants, antioxidants and the degenerative diseases of aging. *Proceedings of the National Academy of Sciences of the United States of America*. 90: 7915–7922. <https://doi.org/10.1073/pnas.90.17.7915>.
- Azaizah, H., Fulder, S., Khalil, K. and Said, O. 2003. Ethnomedicinal knowledge of local Arab practitioners in the Middle Eastern region. *Fitoterapia*. 74(1–2): 98–108. [https://doi.org/10.1016/S0367-326X\(02\)00285-X](https://doi.org/10.1016/S0367-326X(02)00285-X).
- Banihani, S.A. 2019. Testosterone in males as enhanced by onion (*Allium cepa* L.). *Biomolecules*. 9(2): 75. <https://doi.org/10.3390/biom9020075>.
- Bodeker, G., Ong, C.K., Grundy, C., Burford, G. and Shein, K. 2005. *WHO Global Atlas of Traditional, Complementary and Alternative Medicine*. Geneva: World Health Organization. Available at: <https://iris.who.int/handle/10665/43108> (Accessed 16 July 2025).
- Chae, M.R., Kang, S.J., Lee, K.P., Choi, B.R., Kim, H.K., Park, J.K. and Lee, S.W. 2017. Onion (*Allium cepa* L.) peel extract (OPE) regulates human sperm motility via protein kinase C-mediated activation of the human voltage-gated proton channel. *Andrology*. 5(5): 979–989. <https://doi.org/10.1111/andr.12406>.
- Chawre, S., Khatib, M.N., Rawekar, A., Mahajan, S., Jadhav, R. and More, A. 2024. A review of semen analysis: Updates from the WHO sixth edition manual and advances in male fertility assessment. *Cureus*. 16(6): e63485. <https://doi.org/10.7759/cureus.63485>.
- Chittam, K.P. and Deore, S.L. 2012. Pharmacognosy of *Tricholepis glaberrima*: A review. *International Journal of Pharmaceutics*. 3: 1–8.
- Deshmukh, C.K. and Bhagat, S.K. 2015. Effect of *Butea monosperma* on reproductive organs, sperm count and testosterone of male albino rat (*Rattus rattus* Wistar). *Biological Forum – An International Journal*. 7 (1): 1659–1663.
- Durairajanayagam, D. 2018. Lifestyle causes of male infertility. *Arab Journal of Urology*. 16: 10–20. <https://doi.org/10.1016/j.aju.2017.12.004>.
- Emokpae, M.A., Uadia, P.O. and Sadiq, N.M. 2009. Contribution of bacterial infection to male infertility in Nigerians. *Online Journal of Health and Allied Sciences*. 8(1): 6. Available at: <http://www.ojhas.org/issue29/2009-1-6.htm> (Accessed 16 July 2026).
- Gamble, J.S. 1928. *Flora of the Presidency of Madras*. London: West, Newman and Adlard.
- Garg, S.K. 1976. Antifertility screening of plants: Effect of four indigenous plants on early pregnancy in female albino rats. *Indian Journal of Medical Research*. 64(8): 1133–1135.
- Ghatapanadi, S.R., Johnson, N. and Rajasab, A.H. 2011. Documentation of folk knowledge on medicinal plants of Gulbarga district, Karnataka. *Indian Journal of Traditional Knowledge*. 10(2): 349–353. Available at: <http://nopr.niscpr.res.in/handle/123456789/11519>.
- Gupta, A., Mahdi, A.A., Shukla, K.K., Ahmad, M.K., Bansal, N., Sankhwar, P.S. and Sankhwar, S.N. 2013. Efficacy of *Withania somnifera* on seminal plasma metabolites of infertile males: A proton NMR study at 800 MHz. *Journal of Ethnopharmacology*. 149(1): 208–214. <https://doi.org/10.1016/j.jep.2013.06.024>.
- Gupta, R.S., Chaudhary, R., Yadav, R.K., Verma, S.K. and Dobhal, M.P. 2005. Effect of saponins of *Albizia lebbek* (L.) Benth. bark on the reproductive system of male albino rats. *Journal of Ethnopharmacology*. 96(1–2): 31–36.
- Gupta, R.S., Kachhawa, J.B. and Chaudhary, R. 2004. Antifertility effects of methanolic pod extract of *Albizia lebbek* (L.) Benth. in male rats. *Asian Journal of Andrology*. 6(2): 155–159.
- Hinting, A., Soebadi, D.M. and Santoso, R.I. 1996. Evaluation of the immunological cause of male infertility. *Andrologia*. 28(2): 123–126. <https://doi.org/10.1111/j.1439-0272.1996.tb02767.x>.
- Kawra, Monika, Sakshi, Saklani, Sarla and Chandra, Subhash. 2022. *Aegle marmelos*: A medicinal wild aromatic tree. *International Research Journal of Plant Science*. 13(4). <https://doi.org/10.14303/irjps.2022.025>.
- Khan, Nazeerullah and Khan, Nazeerullah. 2012. A pharmacognostic and pharmacological overview on *Caesalpinia bonducella*. pp. 480–496.
- Khourdaji, I., Lee, H. and Smith, R.P. 2018. Frontiers in hormone therapy for male infertility. *Translational Andrology and Urology*. 7 (Suppl. 3): S353–S366. <https://doi.org/10.21037/tau.2018.04.03>.
- Madhu, V. and Naik, D.S. 2009. Ethnomedicinal uses of leaf preparations in Adilabad District, Andhra Pradesh, India. *Ethnobotanical Leaflets*. 13: 1–10.
- Magdalita, P.M., Bayot, R.G. and Villegas, V.N. 1990. *Diplocyclos palmatus* L. Jeffrey: A new weed host of papaya ringspot virus. *Philippine Journal of Crop Science*. 15(3): 163–168.
- Mahmoud, A. and Comhaire, F. 2006. Systemic causes of male infertility. In: *Andrology for the Clinician*. Berlin and Heidelberg: Springer, pp. 57–63. https://doi.org/10.1007/3-540-33713-X_18.
- Plaseska-Karanfilska, D., Noveski, P., Plaseski, T., Maleva, I., Madjunkova, S. and Moneva, Z. 2012. Genetic causes of male infertility. *Balkan Journal of Medical Genetics*. 15: 31–34. <https://doi.org/10.2478/v10034-012-0015-x>.
- Rehman, S., Usman, Z., Rehman, S., Aldraihem, M., Rehman, N., Rehman, I. and Ahmad, G. 2018. Endocrine disrupting chemicals and impact on male reproductive health. *Translational Andrology and Urology*. 7(Suppl. 3): S490–S503. <https://doi.org/10.21037/tau.2018.05.17>.
- Roosbeh, N., Amirian, A., Abdi, F. and Haghdost, S. 2021. A systematic review on use of medicinal plants for male infertility treatment. *Journal of Family and Reproductive Health*. 15(2): 74–81. <https://doi.org/10.18502/jfhr.v15i2.6447>.

- Seetharam, Y., Kotresha, K. and Uplaonkar, S. 2000. *Flora of Gulbarga District*. Gulbarga: Gulbarga University, pp. 27–31.
- Shahid, M.N., Afzal, H.S., Farooq, B., Yousaf, M.R., Ijaz, M.R., Shafqat, T.A. and Karuppannan, M. 2022. A systematic review on the effectiveness of herbal interventions for the treatment of male infertility. *Frontiers in Physiology*. 13: 930676. <https://doi.org/10.3389/fphys.2022.930676>.
- Sharma, R., Biedenharn, K.R., Fedor, J.M. and Agarwal, A. 2013. Lifestyle factors and reproductive health: Taking control of your fertility. *Reproductive Biology and Endocrinology*. 11: 66. <https://doi.org/10.1186/1477-7827-11-66>.
- Shukla, K.K., Mahdi, A.A., Ahmad, M.K., Jaiswar, S.P., Shankwar, S.N. and Tiwari, S.C. 2010. *Mucuna pruriens* reduces stress and improves the quality of semen in infertile men. *Evidence-Based Complementary and Alternative Medicine*. 7(1): 137–144. <https://doi.org/10.1093/ecam/nem171>.
- Shukla, R., Chakravarty, M. and Gautam, M.P. 2008. Indigenous medicine used for treatment of gynecological disorders by tribes of Chhattisgarh, India. *Journal of Medicinal Plants Research*. 2(12): 356–360. <https://doi.org/10.5897/JMPR.9000784>
- Sindhav, S., Odedra, K.N. and Jadeja, B.A. 2024. Exploring the ethnobotanical significance of *Phyllanthus reticulatus* Poir. in Barda Hills, Gujarat, India. *Indian Journal of Applied and Pure Biology*. 39(3): 2068–2081.
- Tajuddin, Ahmad, S. and Latif, A. 2005. An experimental study of sexual function improving effect of *Myristica fragrans* Houtt. (nutmeg). *BMC Complementary and Alternative Medicine*. 5: 16. <https://doi.org/10.1186/1472-6882-5-16>.
- Tripathi, J., Kumari, R., Ashwlayan, V.D., Bansal, P. and Singh, R. 2012. Anti-diabetic activity of *Diplocyclos palmatus* Linn. in streptozotocin-induced diabetic mice. *Indian Journal of Pharmaceutical Education and Research*. 46(4): 352–359.
- Tripathi, R., Dwivedi, S. and Dwivedi, S. 2010. Ethno-medicinal plants used to treat gynecological disorders by tribal people of Madhya Pradesh, India. *International Journal of Pharmacy and Life Sciences*. 1: 160–169.
- Waseem, A., Jamal, A., Ahmad, W. and Fazil, M. 2020. Siras (*Albizia lebbek* (L.) Benth.) and its medicinal uses in Unani medicine: A review. *CellMed*. 10(2): 27–31. <https://doi.org/10.5667/CellMed.2020.0012>.
- World Health Organization. 2010. *WHO Laboratory Manual for the Examination and Processing of Human Semen*. 5th ed. Geneva: World Health Organization.
- World Health Organization. 2025. *Global Report on Traditional and Complementary Medicine*. Geneva: World Health Organization.
- Yan, W. 2009. Male infertility caused by spermatogenic defects: Lessons from gene knockouts. *Molecular and Cellular Endocrinology*. 306(1–2): 24–32.