ISSN 2955-1226 (Print)
ISSN 2955-123(Electronic)

Tropical Journal of Phytochemistry & Pharmaceutical Sciences

Available online at https://www.tjpps.org

Original Research Article

A Review on Traditional Approaches to Erectile Dysfunction

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ABSRTACT

Erectile dysfunction is an increasingly prevalent condition worldwide and has emerged as a significant public health concern, particularly in settings where access to conventional healthcare is limited. Although phosphodiesterase-5 inhibitors such as sildenafil offer proven therapeutic value, their adverse effects and contraindications have intensified interest in safer and more accessible alternatives. This has renewed attention toward traditional medicinal practices, especially in Africa, where diverse plant species have long been used to manage sexual dysfunction and other chronic ailments. In many communities, reliance on phytotherapeutic remedies is driven not only by cultural acceptance but also by limited availability and affordability of modern treatments. A growing body of experimental evidence indicates that several African medicinal plants possess bioactive compounds capable of improving erectile function through antioxidant, anti-inflammatory, neurovascular, and hormone-modulating actions. Despite these promising findings, the precise mechanisms through which these plants exert their effects remain insufficiently defined, limiting opportunities for standardization, clinical translation, and potential drug development. The aim of this review is therefore to synthesize current evidence on African medicinal plants used for erectile dysfunction and to elucidate the mechanistic pathways underlying their biological activity. By consolidating available phytochemical, pharmacological, and mechanistic insights, the review highlights key therapeutic candidates and identifies critical gaps requiring further investigation. This synthesis is intended to support ongoing efforts to validate traditional knowledge, enhance understanding of plant-derived therapeutic mechanisms, and provide a scientific foundation for the development of safer and more effective interventions for erectile dysfunction.

Keywords: Erectile dysfunction, Phosphodiesterase-5 inhibitors, African medicinal plants, Phytotherapy, Mechanistic pathways, Sexual health

Received 24 November 2025
Revised 26 December 2025
Accepted 30 December 2025
Published online 01 January 2026

Introduction

Erectile dysfunction is a multifactorial and prevalent male sexual disorder involving disruptions in one or more components of the erectile response, influenced by biological, psychological, and relational factors. Clinically, it is defined as the persistent inability to achieve or maintain an erection sufficient for satisfactory sexual activity.[1] It represents a significant global health issue and is associated with aging, diabetes mellitus, smoking, cardiovascular and renal diseases, previous surgical procedures, psychological factors, and the use of certain medications.[2] Earlier data suggested that about 52% of cases occurred in men aged 40–70 years,[3] but newer reports indicate an increasing prevalence among men younger than 40.[4] In Africa, erectile dysfunction is highly prevalent among people with diabetes, with estimates of 71.45%,[5] while in Ethiopia, 60.4% of diabetic patients report varying degrees of dysfunction, most of whom receive no targeted treatment.[6] If not effectively addressed, global cases are predicted to reach 322 million by 2025.[7] Management strategies include lifestyle and behavioral modifications—such as glycemic and lipid control, cessation of smoking and alcohol consumption, psychological therapy, exercise, and the use of mechanical devices[8] alongside pharmacological interventions. Available therapeutic agents include phosphodiesterase-5 inhibitors (sildenafil, vardenafil, tadalafil), apomorphine, prostaglandin E1 (alprostadil), phentolamine, and papaverine,[9] with PDE5 inhibitors remaining the first-line treatment worldwide.

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Citation: Sulyman AO, Sanni S, Ibrahim AO. A Review on Traditional Approaches to Erectile Dysfunction. Trop J Phytochem Pharm Sci. 2026; 5(1): 423 – 429 http://www.doi.org/10.26538/tjpps/v5i1.1

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However, the widespread expression of phosphodiesterase-5 contributes to adverse effects such as headache, myalgia, flushing, dyspepsia, nasal congestion, and visual disturbances, and diminished efficacy is observed in individuals with impairments in upstream nitric oxide pathways.[10]

Accordingly, the search for alternative therapeutic agents capable of addressing the limitations of current treatments remains crucial. Erectile dysfunction has a heterogeneous etiology, and disruption of any element within the coordinated neurovascular processes required for erection including neural signaling in the brain and spinal cord and vascular and smooth muscle responses in the corpora cavernosa can lead to dysfunction.[11] Structural or functional impairment of nerves, vasculature, smooth muscle, or connective tissue is common, with chronic illnesses such as diabetes, kidney disease, alcoholism, multiple sclerosis, atherosclerosis, and other vascular and neurologic disorders responsible for approximately 70% of cases.[11] Data from the National Institutes of Health show that 35–50% of men with diabetes experience erectile dysfunction and that several widely used medications including antihypertensives, antihistamines, antidepressants, anxiolytics, appetite suppressants, and cimetidine may contribute to its onset.[11] Psychological influences such as anxiety, stress, depression, guilt, low self-esteem, and performance anxiety account for a majority of cases and often coexist with organic causes.[12] Additional contributing factors include smoking, which impairs vascular integrity, and endocrine abnormalities such as testosterone deficiency.[11] Although sildenafil has markedly improved treatment outcomes for many individuals, it remains ineffective in a subset of patients showing response rates below 70% across various etiologies and is associated with adverse effects.[11] Testosterone therapy benefits only a fraction of men with hypogonadism and may pose hepatotoxic risks, while vasoactive agents such as yohimbine, papaverine, phentolamine, and alprostadil require medical oversight and may be costly.[11,13] Access to these modern therapies is further constrained in rural areas of Uganda and other resource-limited settings. In contrast, numerous traditional medicinal

plants are widely used across Africa to manage erectile dysfunction, yet their ethnobotanical applications remain poorly documented and lack rigorous scientific validation regarding efficacy and safety. This review aims to identify and document medicinal plant species traditionally used in Africa for erectile dysfunction and related male sexual disorders, with a focus on ethnobotanical evidence rather than sociocultural factors.

For millennia, medicinal plants have served as essential therapeutic resources due to their diverse bioactive constituents capable of influencing multiple disease pathways.[14] Across Africa, reliance on phytomedicine remains substantial, and erectile dysfunction more prevalent than often recognized frequently drives men to seek herbal remedies, often obtained through informal or unregulated channels.[14,15] Well-known examples such as *Prunus africana*, traditionally used for prostatic hypertrophy, demonstrate the therapeutic potential of certain botanicals despite limited systematic evaluation.[14] Many plant-based treatments for male sexual disorders, however, remain poorly studied and inadequately documented, raising concerns about the loss of indigenous knowledge amid sociocultural change and expanding Western influence.[16] International instruments such as the Convention on Biological Diversity highlight the need to protect traditional knowledge systems and support sustainable biodiversity use.[17] Growing global interest in natural therapies, reinforced by WHO initiatives to monitor and integrate traditional medicine (2002–2005 strategy), continues to elevate demand for herbal treatments.[18-20] Yet approximately 72% of medicinal plants used for erectile dysfunction are harvested from the wild, and unsustainable collection particularly of roots and stems poses serious ecological risks unless domestication and conservation measures are implemented urgently.

Developing effective conservation programmes for medicinal species used in drug discovery is essential, particularly where traditional knowledge informs therapeutic application. Species highlighted in this review, such as *Warburgia ugandensis* and *Cirtopsis articulata*, which are traditionally used for sexual impotence and erectile dysfunction, warrant priority protection due to their cultural and therapeutic significance. As biotechnology advances and genetically modified organisms become more common in agriculture and healthcare, public preference for natural products continues to increase.[21] This trend aligns with a growing global interest in natural product research and renewed scientific engagement with plant-derived medicines. Medicinal plants used for male sexual disorders are likely to retain their value for present and future generations, and their longstanding empirical use indicates meaningful therapeutic potential. This underscores the need for structured collaboration between conventional healthcare systems, traditional practitioners, and Non-Governmental Organizations (NGOs) such as Rukararwe in Bushenyi to ensure safe and supervised use of herbal treatments. National institutions, including the Natural Chemotherapeutics Research Laboratory in Wandegeya and existing health-sector public–private partnerships, should contribute to policy development and regulatory frameworks that support the integration of validated herbal therapies into healthcare in Nigeria. Herbal products that meet established safety standards may be licensed by regulatory authorities and used as complementary therapeutic options. Sexual impotence and erectile dysfunction remain substantial yet often under-recognized health challenges among African men, reinforcing the need for continued research on the effectiveness and safety of traditional remedies.

Although true congenital impotence is rare, erectile dysfunction becomes increasingly common with advancing age, with estimates indicating that about 40% of men in their 40s, 50% in their 50s, and 60% in their 60s experience symptoms.[22] In addition to aging, several social and medical factors including unemployment, diabetes, hypertension, HIV/AIDS, dyslipidemia, psychological stress, smoking, and obesity substantially increase risk.[22] The condition imposes a considerable psychosocial burden, affecting self-esteem, mood, interpersonal relationships, and overall quality of life.[22] With its growing prevalence in Nigeria, particularly among middle-aged and older men, accurate diagnosis and timely, appropriate treatment are essential.

From a conservation perspective, the demand for medicinal plants is expected to rise as more individuals seek gentle, nature-based health solutions.[19] Notably, over 72% of plant species used for erectile dysfunction are harvested from the wild, and despite their traditional origins, interest in these remedies is also growing in high-income regions.[19] This trend highlights the urgent need for effective conservation strategies targeting species of therapeutic significance, informed by indigenous knowledge systems. Priority should be accorded to species identified in this review such as *Warburgia ugandensis* and *Cirtopsis articulata* due to their cultural importance and established use in treating erectile dysfunction and sexual impotence. As biotechnology and genetically modified organisms become increasingly prevalent in agriculture and healthcare, public preference is shifting toward natural products,[23] and global research into plant-based therapies has intensified, reflecting renewed scientific focus on natural sources for drug development.

Across Africa, thousands of medicinal plant species with reported aphrodisiac or sexual-enhancing effects are traditionally used, and many have entered informal commercial markets under local proprietary names, including Impotex, TigerPower, SuperLove, uBangalala, and Burantashi. Among the Zulu of South Africa, species of *Eriosema*, collectively called uBangalala, have a long history of use against impotence, typically administered as milk infusions or root decoctions.[24] Traditional practice recommends dosing two to four hours before sexual activity, with reported effects lasting four to six hours. While these preparations are taken with milk analogous to the effect of a fatty meal on sildenafil absorption—the pharmacokinetics and mechanisms of action on cGMP or PDE-5 for *Eriosema* species remain undefined. Given economic constraints and limited access to modern healthcare in many African communities, reliance on plant-based therapies remains both practical and culturally coherent. Consequently, herbal medicines and phytotherapeutics provide a critical option for managing erectile dysfunction in rural and peri-urban populations where biomedical services are scarce. Earlier studies identify *Eriosema kraussianum* (Fabaceae) as a promising South African species for treating impotence and erectile dysfunction. In rabbit models, Drewes *et al.*[25] demonstrated beneficial erectile effects of its bioactive constituents. Beyond pharmacological benefits, these plant-based preparations offer notable psychosocial advantages in rural African contexts. Considering that men with organic, psychogenic, or mixed erectile dysfunction respond to sildenafil, it is plausible that *E. kraussianum* extracts could serve as an effective alternative for similar patient groups in South Africa.

Frequently Used Medicinal Plants in Africa

The most frequently cited species for managing erectile dysfunction were *Asparagus africanus* Lam. (eight citations), *Ricinus communis* L. (six citations), and *Carissa spinarum* L. (four citations), followed by *Ferula communis* L., *Aloe macrocarpa* Tod., and *Tragia brevipes* Pax, each with three citations. Consistent with these findings, *A. africanus* is also used in Nigeria for erectile dysfunction,[26] likely due to its saponin content,[27] as saponin-rich plants are known to enhance erectile function.[28] *R. communis*, the second most cited species, has been shown *in vivo* to increase serum testosterone and improve multiple sexual behavior parameters, supporting traditional use.[29] *C. spinarum* roots are similarly employed for sexual weakness in South and Central Benin, aligning with Ethiopian practices, emphasizing the need for pharmacological validation of these species as potential therapeutic leads. Several botanicals traditionally cited in Ethiopia including *Syzygium aromaticum*, *Zingiber officinale*, and *Gloriosa superba* have demonstrated aphrodisiac effects. Ethanolic extracts of *S. aromaticum* enhanced libido, erection, and mating performance in rats,[29] while its hexane flower-bud extract increased key steroidogenic enzymes and testosterone in mice.[30] Aqueous extracts of *Z. officinale* elevated testicular weight, serum testosterone, and epididymal α-glucosidase in male rats.[31] Extracts of *G. superba* markedly increased sexual and orientation behaviors, likely mediated by steroids, saponins, and alkaloids.[32] These findings support their ethnomedical use for sexual dysfunction in Ethiopia. However, traditional medicinal flora in the region is increasingly threatened by deforestation, overgrazing, land degradation, agricultural expansion, and population pressure,[33] placing valuable bioactive species at risk. Early pharmacological assessment of

these reported plants for erectile dysfunction is therefore urgently needed.

Promising medicinal plants for the treatment of male erectile dysfunction in Nigeria

Plants contain a diverse range of phytochemicals, including alkaloids, terpenoids, steroids, and polyphenols.[34] Among these, polyphenols have attracted considerable interest due to their broad therapeutic potential. They exhibit antioxidant, antibacterial, antiviral, anticancer, antidiabetic, anti-inflammatory, and antimutagenic activities.[35] Polyphenols are abundant in fruits, vegetables, teas, nuts, seeds, wines, and coffee,[36] and include tannins, phenolic acids, stilbenoids, catechins, procyanidins, and flavonoids.[37] However, limited research has specifically examined their role in managing erectile dysfunction (ED), despite evidence suggesting their protective effects on vascular endothelium against oxidative stress.[36] Several studies have explored medicinal plants and their mechanisms of action in male sexual dysfunction.

1. *Arctium l-appa* L.
Arctium lappa L. (Compositae), commonly known as burdock, is traditionally used to manage sore throat and dermatitis and exhibits anti-inflammatory, antiviral, antitumor, and antidiabetic activities.[38] It is also employed as a sexual stimulant and for treating infertility and erectile dysfunction.[39] JianFeng[39] reported that aqueous root extracts (300–1200 mg/kg, 7 days) enhanced mounting, intromission, and ejaculation frequencies and increased serum testosterone in male rats, effects attributed to saponins, lignans, flavonoids, and alkaloids acting through central and peripheral pathways. No clinical studies have yet evaluated the safety, efficacy, or tolerability of *A. lappa* in men with erectile dysfunction.

2. *Anogeissus leiocarpus*
Anogeissus leiocarpus (Combretaceae), known as African birch, is traditionally used to treat dermatitis, gastrointestinal disorders, cough, envenomation, diarrhoea, jaundice, liver inflammation, headache, toothache, respiratory infections, diabetic ulcers, and syphilis.[40,41] It is also used for erectile dysfunction. Ademosun *et al*.[42] found that stem bark extract (50–100 mg/kg, 21 days) ameliorated paroxetine-induced sexual dysfunction in male rats by inhibiting acetylcholinesterase (AChE), phosphodiesterase-5 (PDE5), and arginase, while increasing nitric oxide levels. However, no clinical evidence exists to confirm similar benefits in humans.

3. *Asteracantha longifolia* (L.) Nees
Asteracantha longifolia (Acanthaceae) is traditionally used for rheumatism, kidney disorders, jaundice, oedema, gout, and libido enhancement and contains isoflavone glycosides, stigmasterol, lupeol, fatty acids, and alkaloids.[43] Chauhan *et al.*[44] reported that ethanolic seed extract (100–200 mg/kg, 28 days) increased mounting frequency and reduced mounting latency in male rats, supporting its traditional aphrodisiac use. No clinical trials have assessed its safety or efficacy for erectile dysfunction in men.

4. *Bulbine natalensis* (Baker)
Bulbine natalensis (Asphodelaceae), known as rooiwortel, ibhucu, or ingcelwane, is traditionally used to treat wounds, skin diseases, gastrointestinal disorders, diabetes, sexually transmitted infections, and arthritis.[26] It is also used to enhance sexual performance. Yakubu and Afolayan[26] showed that aqueous stem extract (25–100 mg/kg, 7 days) improved sexual behaviour, penile erection, and increased testosterone and luteinizing hormone levels in male rats, while a subsequent study demonstrated enhanced gonadotropin and testosterone secretion and increased copulatory behaviour.[45] These effects are likely related to its tannins, anthraquinones, phenolics, flavonoids, steroids, alkaloids, and triterpenes.[26] Despite encouraging preclinical data, no human studies have evaluated *B. natalensis* for erectile dysfunction.

5. *Camellia sinensis*
Camellia sinensis (Theaceae), commonly known as the tea plant, is consumed as green, black, and oolong teas. It exhibits antilisterial activity[46] and aphrodisiac effects,[47] with the latter first demonstrated by Ratnasooriy *et al*.[47] Oral administration of black tea extract (84–501 mg/mL) to male rats increased sexual arousal, copulatory behavior, and penile erection within hours, and repeated dosing (84 mg/mL for three days) elevated serum testosterone. These results indicate that *C. sinensis* functions as a safe and effective sexual stimulant in preclinical models, although its safety and efficacy have not yet been evaluated in human studies.

6. *Cinnamomum cassia*
Cinnamomum cassia (Lauraceae) is traditionally used as a spice and for managing arthritis, diarrhoea, oedema, and ED.[48] Goswami *et al.*[49] reported that methanolic bark extract inhibited arginase *in vitro*, increased penile arginine and cGMP levels, and produced dose-dependent relaxation of cavernous smooth muscle, while oral administration (100 mg/kg for 28 days) improved penile tissue architecture and copulatory behaviour. These findings support its use in Ayurvedic medicine as a sexual stimulant, though clinical confirmation in humans remains unavailable.

7. *Curcuma longa* Linn
Curcuma longa (Zingiberaceae), commonly known as turmeric, is traditionally used for gastrointestinal, dermatological, metabolic, and immunodeficiency disorders.[50] Its principal bioactive compound, curcumin, modulates erectile physiology.[51] In male rats, oral curcumin (2–10 mg/kg) increased cavernous tissue cGMP and heme oxygenase-1 activity, both central to erectile function. To date, no clinical studies have evaluated curcumin's effects on erectile function in humans.

8. *Cyperus esculentus* L.
Cyperus esculentus (Cyperaceae), commonly known as tiger nut or "Hab Al-zulom," is used in Ayurvedic medicine to enhance sexual function.[52] In male rats, oral administration of raw powder (1–2 g/kg, 30 days) increased testosterone and intromission frequency.[53] Its vitamin C, vitamin E, quercetin, and zinc content likely underpins these hormonal effects, and dietary supplementation further suppressed arginase, AChE, and adenosine deaminase while elevating NO production. No clinical studies have examined its safety or efficacy in humans.

9. *Epimedium sagittatum*
Epimedium sagittatum, or "horny goat weed," native to Central Asia and China, is traditionally used for cancer, osteoporosis, cardiovascular disease, and ED.[54] Its principal constituent, icariin, inhibits PDE5 and enhances NOS isoforms, testosterone, and antioxidant activity in rodent models.[55–58] Additional derivatives (ES01–ES03b) exhibit PDE5 inhibition comparable to sildenafil and tadalafil.[59] Although preclinical data are compelling, no clinical trials have evaluated its efficacy in humans.

10. *Ficus capensis*
Ficus capensis (Moraceae) leaves are traditionally used to manage diarrhoea, gonorrhoea, ulcers, and male infertility.[60] Akomolafe *et al*.[61] showed that aqueous leaf extract inhibited AChE, ACE, and arginase in isolated rat penile tissue while scavenging ROS and preventing lipid peroxidation. HPLC analysis identified multiple active constituents, including gallic acid, catechin, chlorogenic acid, caffeic acid, ellagic acid, epicatechin, rutin, quercetin, quercitrin, and kaempferol. These findings indicate potential utility for ED, but no clinical studies have evaluated its effectiveness in humans.

11. *Garcinia kola*
Garcinia kola (Clusiaceae) or bitter kola has been traditionally used for diabetes, liver disorders, diarrhoea, and sexual dysfunction.[62,63] Oral administration of 70% ethanolic seed extract (100–400 mg/kg, 56 days) in male Wistar rats enhanced sexual desire, penile erection, serum testosterone, and spermatogenesis. No clinical trials have evaluated its safety or efficacy in humans.

12. *Ginkgo biloba*
Ginkgo biloba (Maidenhair tree) is traditionally used to manage depression and ED.[64,65] *In vitro*, EGb 761 extract stimulated testosterone production in Leydig cells. In Long-Evans male rats, oral dosing improved mating behaviour, an effect attributed to dopaminergic modulation, although serum testosterone did not change.[66] No clinical studies have assessed its efficacy for ED in humans.

13. *Gloriosa superba* L.
Gloriosa superba (Liliaceae) is traditionally used to manage ED, gonorrhoea, gout, and dermatitis.[66,67] Oral administration of aqueous, chloroform, or alcohol extracts (100–500 mg/kg, 15 days) enhanced testosterone levels and copulatory performance in male rats. Its key bioactive constituents include alkaloids, saponins, and steroids. No clinical trials have evaluated its safety or efficacy in humans.

14. *Hunteria umbellata*
Hunteria umbellata (Apocynaceae) is traditionally used for anaemia, diabetes, obesity, and male infertility.[68,69] In male Wistar rats, extract administration (50–400 mg/kg) decreased PDE5, ACE, and AChE activity while increasing LH, FSH, and testosterone in a dose-dependent manner. No clinical studies have evaluated its safety or efficacy.

15. ***Massularia acuminata***
Massularia acuminata (Rubiaceae) is widely used as an aphrodisiac.[70] Oral administration of aqueous stem extract (250–1000 mg/kg, 5 days) enhanced libido, copulation, and serum testosterone in male rats, with identified constituents including flavonoids, saponins, tannins, anthraquinones, alkaloids, and phenolics.[71] No clinical data exist to validate its effects.

16. ***Microdesmis keayana***
Microdesmis keayana (Pandaceae) is traditionally used to enhance sexual arousal and performance.[72] Oral administration of aqueous root extract (150 mg/kg) or isolated alkaloids (3 mg/kg, 2 h) increased mating behaviour in male rats, mediated via NO-dependent vasodilation. No clinical data in humans is available.

17. ***Moringa oleifera* Lam**.
Moringa oleifera (Moringaceae) leaf and seed extracts contain bioactive compounds such as gallic acid, catechin, chlorogenic acid, ellagic acid, epicatechin, rutin, quercitrin, quercetin, isoquercitrin, and kaempferol.[73–75] In male rats, extracts (10–500 mg/kg) enhanced PDE-5 inhibition, testosterone levels, Leydig cell numbers, spermatogenesis, libido, and copulatory behaviour. No clinical studies have assessed its effects in humans.

18. ***Myristica fragrans***
Myristica fragrans (Nutmeg, Myristicaceae) is traditionally used for gastrointestinal disorders and arthritis and possesses aphrodisiac properties.[76,77] Oral administration of seed extract (100–400 µg/mL) in male rats inhibited PDE-5, arginase, AChE, ACE, and oxidative stress in penile tissue, thereby improving erectile function. HPLC analysis identified phenolic compounds including gallic acid, catechin, and quercetin. No clinical trials have validated their efficacy in humans.

19. *Ocimum gratissimum* Linn
Ocimum gratissimum (Lamiaceae) treats headaches, fever, diarrhoea, and male sexual dysfunction.[78,79] Aqueous leaf extract (20–100 µg/mL) reduced arginase and AChE activities in penile and testicular tissues in male Wistar rats. Clinical evidence for safety and efficacy is lacking

20. *Pseudopanax arboreus*
Pseudopanax arboreus (Araliaceae), known as five fingers in Cameroon, possesses anti-inflammatory, antioxidant, and aphrodisiac properties.[80,81] Oral administration of methanol leaf extract (46.5–93 mg/kg, 21 days) in male Wistar rats increased testosterone, testicular weight, and mounting and intromission frequencies, effects likely mediated by flavonoids, alkaloids, saponins, steroids, tannins, and triterpenoids. No clinical studies have evaluated its safety or efficacy in humans.

21. *Telfairia occidentalis*
Telfairia occidentalis (Cucurbitaceae), commonly known as fluted pumpkin, is traditionally used to manage spasms, anaemia, cancer, diabetes, malaria, and infertility.[82–84] In cultured rat corpus cavernosum, water extract of seeds (2–50 µL) inhibited arginase, AChE, ACE, and PDE5, indicating potential utility for ED. No clinical studies in humans have been conducted.

22. *Crocus sativus* L. – Saffron
Crocus sativus is traditionally used as a spice and aphrodisiac.[85] Clinical studies have shown that daily administration (200 mg/day) improved penile rigidity, tumescence, and IIEF scores in men with ED. In another study, diabetic men treated with saffron gel also experienced improvements in erectile function, although larger trials are required to confirm safety and efficacy.[86]

23. *Eurycoma longifolia* Jack
Eurycoma longifolia (Simaroubaceae), commonly known as *Tongkat ali*, is traditionally used to enhance fertility, sexual vitality, and testosterone levels.[87–89] Clinical studies in men with low testosterone demonstrated improvements in sexual function, AMS scores, and serum testosterone following daily oral administration of 200 mg of the extract. Larger-scale studies are recommended to further validate these effects.

24. *Panax ginseng*
Panax ginseng (Araliaceae) is traditionally used as an aphrodisiac to enhance sexual performance[90-93] Clinical trials with standardized ginseng extracts have shown improvements in penile erection and premature ejaculation, alongside increased IIEF scores. Larger studies are necessary to confirm long-term safety and efficacy.

25. *Tribulus terrestris*
Tribulus terrestris (Zygophyllaceae) is traditionally used to manage high blood pressure, urinary infections, and to enhance sexual desire.[94–97] Animal studies and small clinical trials have reported increases in testosterone, dihydrotestosterone, and sexual performance following extract administration. Larger clinical trials are required to confirm their efficacy and safety.

26. Yohimbine
Yohimbine, an alkaloid derived from *Pausinystalia yohimbe*, is used to manage ED.[98–100] Clinical trials administering 5.4–10.8 mg orally over 8 weeks demonstrated improvements in penile rigidity and sexual questionnaire scores with minimal adverse effects. Larger trials are needed to provide definitive evaluation of its efficacy and safety.

27. VigRx Plus
VigRx Plus is an herbal formulation containing *P. ginseng*, *G. biloba*, *E. sagittatum*, *T. terrestris*, and other botanicals.[101] In a 12-week double-blind study (2 capsules twice daily), men with mild to moderate ED demonstrated significant improvements in erectile function, with good tolerability and only mild adverse effects. Larger clinical trials are required to further validate their safety and efficacy.

Conclusion
Erectile dysfunction is a complex, multifactorial condition driven by nitric oxide synthase impairment, insulin resistance, oxidative stress, renin-angiotensin system dysregulation, and altered acetylcholinesterase activity. Conventional therapies including PDE5 inhibitors, alprostadil, penile prostheses, and hormonal treatments are often limited by adverse effects, highlighting the urgent need for safer and more accessible alternatives. Accumulating preclinical and *in vitro* evidence demonstrates that medicinal plants and natural bioactive compounds exert significant pro-erectile effects, offering a compelling rationale for their therapeutic potential. Rigorous, well-controlled clinical trials are imperative to confirm safety, efficacy, and mechanism of action, paving the way for the development of novel, effective, and culturally acceptable interventions for erectile dysfunction.

Conflict of interest
The authors declare no conflict of interest

Authors' Declaration
The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them

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