CHANDRAKANTHI CHOORNAM: SIDDHA MEDICINE INDICATED FOR OLIGOSPERMIA – A REVIEW

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ABSTRACT

Oligozoospermia, Teratozoospermia and Asthenozoospermia are the main basis of Infertility in men. Siddha sastric preparation Chandrakanthi Choornam, a herbomineral formulation from Chikicha rathna deepam-part-II is indicated in Oligospermia, Poly urea, Vaginal disease, Venereal disease and all biliousness. It comprises of 25 ingredients such as Curculigo orchioides, Madhuca longifolia, Cinnamomum verum, Cinnamomum tamala, Syzygium aromaticum, Coscinium fenestratum, Mesua ferrea, Maerua arenaria, Adhatoda vasica, Moringa oleifera, Lawsonia inermis, Vitis vinifera, Bombax ceiba, Bambusa aurundinaceae, Phoenix dactylifera, Illicium verum, Mucuna pruriens, Cyperus rotundus, Glycyrrhiza glabra, Tribulus terrestris, Cuminum cyminum, Costus speciosus, Myristica fragrans, Alternanthera sessilis and Asphaltum punjabinum. This review article has been presented to document the therapeutic potential, preclinical and clinical studies of the herbs and mineral of chandrakanthi choornam in regard to the treatment of oligospermia. Phytochemicals like amino acids, steroids, flavonoids, phenols, tannins, saponins and nutritional elements like calcium, magnesium, iron, zinc and copper were identified to defend the spermatogenic activity. Traditional uses of the ingredients claims its indication in treating spermatorrhoea, male infertility, impotency, premature ejaculation, oligospermia and nocturnal emission. Shilajith act as the synergistic enhancer of other drugs. Some drug has aphrodisiac action and antioxidative properties. The review validates its effectiveness in treating oligospermia and claim its support in clinical application.

Keywords
Chandrakanthi Choornam, Inthriya Nashtam, Infertile Men, Oligozoospermia, Asthenozoospermia, Teratozoospermia.

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INTRODUCTION
In fertile men fail to impregnate their counterpart because of no sperm (azoospermia), too little sperm (oligozoospermia), abnormal sperm morphology (tetratozoospermia) and insufficient sperm motility (asthenozoospermia) [1]. Semen is formed by the vital parts of bone marrow mixed with blood [2]. Peripheral blood or the bone marrow is the common source of stem cells. Hematopoietic stem cells are produced in bone marrow. According to research, early-stage sperm cells has been formed from human bone marrow [3]. Reproductive failure in younger generation is commonly due to stress [4]. Men and women can produce antibodies against spermatozoa and the immune condition interfere with reproductive success [1]. Alcohol abuse creates shrinkage of the testes, impaired testosterone production, reduced sperm counts, altered motility and abnormal sperm shapes [5]. Longer duration and poor control of diabetes, hyperprolactinemia and ischemic heart disease may cause the increased severity of erectile dysfunction and decreased level of testosterone [6]. Antioxidant activity is of importance since peroxidative damage is presently regarded as the important cause of impaired testicular function [7]. Aphrodisiac drugs act by altering the level of testosterone [8]. The herbs classified as an adaptogen helps the body adapt to stress which is one of the common causes of sexual problems [9]. Siddha sastric preparation Chandrakanthi Choornam (CKC), a herbomineral formulation which comprises of 25 ingredients is indicated in Inthriya nashtam (Oligospermia), Maga mouthisha rogam (Poly urea), Yoni thosham (Vaginal disease), Ratha premegam (Venereal disease) and Sarva pitha rogam (All biliousness) [10].

Conventional hormone therapies given for longer periods are not effective, expensive and have adverse effects. Invasive Assisted Reproductive Technology creates emotional and economic stress and does not guarantee success rates. Oligospermic patients desiring for non-invasive, inexpensive and clinically efficacious treatment can look forward to well tolerated Siddha medicine chandranthi choornam which provides hope by improving sperm parameters. In this context the review mainly focuses on the spermatogenic, aphrodisiac, antioxidant, immunomodulatory, anidiabetic, adaptogenic and haemopoietic activity of the specific part of the herbs and mineral of the CKC and to justify its indication in Oligospermia. The botanical name, part used and traditional uses of the ingredients of CKC as mentioned in Siddha literature and Textbooks on herbal medicine are described in [Table 1]. Literature was collected from different sources such as Siddha classical texts, books in the library of the National Institute of Siddha, manuscripts, internet databases and online books. The main objective is to evaluate and document the therapeutic potential, preclinical and clinical studies of the herbs and mineral of the CKC and to put forth the information to support its further clinical application in curing oligospermia. Unpublished investigations of CKC include physico-chemical and phytochemical studies, TLC, HPTLC, toxicity study, spermatogenic activity, clinical trial for oligospermia and the outcome obtained provide it as a right treatment modality for oligospermic patients by improving sperm parameters.

Table 1: Traditional uses of Ingredients of CKC as mentioned in Siddha literature and Textbook on herbal medicine.

<table>
<thead>
<tr>
<th>Botanical / Mineral name</th>
<th>Part used</th>
<th>Action/ Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curculigo orchioides</td>
<td>Rhizome</td>
<td>Sexual deility [11], Bogum kuraivu [12]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Impotency [16]</td>
</tr>
<tr>
<td>Madhuca longifolia</td>
<td>Flower</td>
<td>Aphrodisiac [15]</td>
</tr>
<tr>
<td>Cinnamomum verum</td>
<td>Stem bark</td>
<td>Aphrodisiac [13], Aanmai peruki [17]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thathunattam [13-15]</td>
</tr>
<tr>
<td>Cinnamomum tamala</td>
<td>Leaf</td>
<td>Thathunattam [13-15]</td>
</tr>
<tr>
<td>Syzygium aromaticum</td>
<td>Flower bud</td>
<td>Sukilanatam [13,14], Shena vinthu [15]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aphrodisiac [18]</td>
</tr>
<tr>
<td>Coscinium fenestratum</td>
<td>Stem bark</td>
<td>Astringent [15], Tonic effects [13]</td>
</tr>
<tr>
<td>Mesua ferrea</td>
<td>Flower</td>
<td>Vinthu nashtam [14], Male gonorrhoea [15]</td>
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<td></td>
<td></td>
<td>Impotency [19], Aphrodisiac [16]</td>
</tr>
<tr>
<td>Maerua arenaria</td>
<td>Root tuber</td>
<td>Thathu viruthi [15]</td>
</tr>
<tr>
<td>Moringa oleifera</td>
<td>Seed</td>
<td>Veneral disease [11], Neerthu pona vinthu [13]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vinthu thadipu [14,15], Aphrodisiac [18]</td>
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<td></td>
<td></td>
<td>Premature ejaculation [15]</td>
</tr>
<tr>
<td>Lawsonia inermis</td>
<td>Seed</td>
<td>Menorrhagia, vaginal discharge</td>
</tr>
<tr>
<td>Vitis vinifera</td>
<td>Dried fruit</td>
<td>Leucorrhoea [20]</td>
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<td></td>
<td></td>
<td>Anti oxidant, Aphrodisiac</td>
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<td></td>
<td></td>
<td>Immunostimulant [21], Enriches blood [22]</td>
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<tr>
<td></td>
<td></td>
<td>Sukila viruthi [15], Anmai kuraivu [12]</td>
</tr>
<tr>
<td>Bombax ceiba</td>
<td>Gum</td>
<td>Spermatorrohoea [11], Sukilam balapadum [13]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vinthu undakum [14], Aphrodisiac [15,22]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semen in suspension [2]</td>
</tr>
<tr>
<td>Bambusa aurundinacea</td>
<td>Salt</td>
<td>Aphrodisiac [11,13,15]</td>
</tr>
<tr>
<td>Phoenix dactilifera</td>
<td>Unripe fruit</td>
<td>Aphrodisiac [13,15,18,21], Impotence</td>
</tr>
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<td></td>
<td></td>
<td>Infertility [21], Diabetes [15]</td>
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<tr>
<td>Ilicium verum</td>
<td>Fruit</td>
<td>Thathu viruthi [14], Anmai kuraivu [12]</td>
</tr>
<tr>
<td>Costus speciosus</td>
<td>Root</td>
<td>Aphrodisiac [15,18,19,21] Thathunatam [13,14]</td>
</tr>
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</table>
Pharmacological studies done on the drugs of CKC

Curculigo orchioides Gaertn (Family – Amaryllidaceae; Figure 1)

Synonyms: Golden eyegrass (Eng), Nilapanaai kizhangu (Tamil), Taalmuuli (Sanskrit) [11]. It is a small herb with tuberous root which is stout, short, elongated and up to 10 cm long. Distributed in India, Nepal, China, Japan, Australia and Malaysia [25]. Rhizomes are therapeutically used in venereal diseases [26] spermatorrhoea, male infertility [27] bogum kurai (sexual debility), thatu pushthi (seminal strength), impotency and has aphrodisiac action [Table 1]. The active compounds are sterols, glycoside and saponins. Steroidal constituent in the rhizome enhances the spermatogenesis and raise the androgen level [7]. 100 mg/Kg b. w. of ethanolic extract of rhizome had increased the spermatoocyte and spermatis in rats [5]. The lyophilized aqueous extract at a dose of 200 mg/kg body weight had showed improvement in sexual activity [28]. The aqueous extract of the rhizome ameliorates the sexual dysfunction in male rats against streptozotocin-induced hyperglycemic stress [29]. The aqueous extract ameliorates the reduced spermatogenesis and heat shock protein generation in rats and protect the reproductive organs from heat induced sexual dysfunction [25]. It relaxes the corpora cavernosa smooth muscles so that more blood can be pumped into and helps to overcome erectile impotence. Ethanolic extract is reported to have androgen-like effect and adaptive effect [27]. Even animals like wild beer consumes few days before intercourse [16]. Immunostimulant and antioxidant activities are reported [5].

Tribulus terrestris Linn (Family – Zygophyllaceae; Figure 2)

Synonyms: Puncture Vine (Eng), Nerunjil (Tamil), Gokshura, Trikanta (Sanskrit) [11]. Small annual herb grows up to 10 to 60cm height. It has carpel fruits and looks like a stellate [30]. Fruits are used in male reproductive disorders [31] spermatorrhoea, premature ejaculation [32] Infertility [33] thathu sheena rothi (oligosperma), impotence, testosterone booster, increases the semen, and has Proerectile aphrodisiac action [Table 1]. Dioscin- increases the free testosterone level in men and is responsible for sexual energy, sterols- protects the prostate swelling and steroidal saponins-controls the immune system [34]. Sterols has meiosis inducing effect and helps in the meiosis during the Spermatogenesis. Tribulus terrestris (TT) is found to be effective in treating men with Antisperm antibodies [35]. Clinical studies have shown useful effects in the patients suffering from Erectile Dysfunction (ED). The active chemical a steroidal glycoside, Protodioscin (PTN) in patients with hypogonadism for 30–90 days enhanced the level of testosterone and leutinizing hormone (LH). Treatment with TT for 3 months has improved sperm count and motility in patients with low seminal indices [36]. Exposure to Cadmium (Cd) affects the hypothalamus-pituitary-testicular axis, decreases the follicle-stimulating hormone (FSH), LH, testosterone and reduces the male fertility. TT due to its antioxidant and metal chelating effect offered a protective effect on testes against Cd-induced testicular damage in rats [31]. TT extract promotes the production of LH, testosterone and build muscle mass resulting in the development of male-like characters and also promotes the production of red cells and improves the blood circulation [37]. Rabbits which received PTN had proerectile activity [30]. TT established aphrodisiac activity in aged and sexually sluggish males [38] 5 mg/kg p.o. for 8 weeks in Sprague-Dawley rats increased sexual activity and intracavernous pressures (ICP). Furostanol glycoside fraction of TT for 14 days in castrated rats at 5,10, and 25 mg/kg, p.o. increased sexual stimulation [8].100 mg/kg of lymphophilized powder in male albino rats proved anabolic effect and increased the body weight and reproductive organs without toxicity [39].


**Mucuna pruriens**

*Family – Leguminosae; Figure 3*

Synonyms: Cowhage (Eng), Poonaikkaali (Tamil) Adhiganandha, Kanduraa (Sanskrit) [11]. *Mucuna pruriens* (*M. pruriens*) is an annual, climbing shrub with long vines that reach over 15 m length, found in India, Africa and the Caribbean. The plant is famous for its severe itchiness produced in contact with the young foliage and the seed pods [40]. Seeds are therapeutically given in male reproductive disorders, impotency [41] inhibition of hyperprolactinemia in man [40] fertility in men [42] male vitality [43] spermatorrhoea, male virility, sexual dysfunction, thathu viruthi (increase the sperm), nocturnal emission and has aphrodisiac action [Table 1]. Bioactive substances include mucunadine, mucunine, mucunadinime, nicotine, prurinidine, and metals like copper, magnesium, manganese, zinc and iron are present [44]. Both seed powder and extract of *M. pruriens* have been reported to be efficient in fighting the stress mediated compromise in spermatogenesis. *M. pruriens* have the potential to improve spermatogenic loss and makes treatment of choice for extraction of quality sperm to utilize in in-vitro fertilization procedures. Improves spermatogenesis by revival of the endocrine axis and testicular homeostasis, leading to improved semen quality. Anti-oxidant, anti-diabetic and adaptogenic activity has been reported [45]. Treatment with *M. pruriens* in all the infertile study groups showed increased sperm concentration and motility [46]. Ethanolic extract at 150,200,250 mg/kg p.o dose showed significant increase in sexual behaviour in Wistar albino rats [47]. By improving antioxidant defence system sperm damage in ageing is decreased. It corrects the fructose concentration in seminal plasma of men with infertility [16].

**Asphaltum punjabinum**

*Figure 4*

Synonyms: Mineral pitch, bitumen (Eng); Ueranyum, Kalmartam (Tamil); Silaras, Shilajit, (Sanskrit) [11]. Shilajit is an exudation from rocks in the Himalaya of India. It is also found in Bhutan, Nepal, China and Tibet. Iron Shilajit commonly known as Gomuthra Shilajit is blackish brown in colour and is credited as the best. It is a mostly used natural mineral and is one of the ingredients in several herbomineral formulations. It is a rasayana that tonifies the action of the seven body constituents that is plasma, blood, muscle, fat, bone, marrow and reproductive fluids (semen). It amplifies the uses of other herbs by enhancing the bioavailability in the body [48]. Shilajit affects the reproductive and nervous tissues and has a definite action on the endocrine system. Given in the treatment of both male and female infertility [49] thyroid disorder [50] inthriya nashtam (Oligospermia), spermatorrhoea, sexual weakness [Table 1] anaemia, genitourinary diseases [51]. Shilajit humus contains organic (60-80%) and mineral matter (20-40%) with 5% of trace elements (Zn, Fe, Ca, Mg, Mn, Cu, Mo, P) [52,53]. Gums, traces of resin, albuminoids, fattyacid, hippuric acids are present [49]. It acts as a synergistic enhancer of other drugs. Organic substance of Shilajit plays role in transporting mineral substances to their target cell [54].

Main active principles are Benzoic acid and benzoates responsible for the urinous odour and fulvic acid (FA) and humic acid responsible for the Shilajit activities [55]. Fulvic acid is the carrier molecule which transports the nutrients into the deeper tissues and removes toxins from the body. It also helps in the absorption of iron into the body and makes it bioavailable to bone marrow stem cells for the formation of blood [50]. Spermatogenic activity is reported in rats [55]. The serum testosterone level was found to be higher in rats treated with Shilajit. The quality of semen is improved due to the inclusion of Processed Shilajit components [56]. Reported to have immunomodulator [54] and antioxidant activity [51].

**Moringa oleifera**

*Family – Moringaceae; Figure 5*

Synonyms: Horseradish, Drumstick (Eng), Murungai (Tamil), Shiguru (Sanskrit) [11]. *Moringa oleifera* (*M. oleifera*) is a Short, slender, perennial tree, grows to about 10 m tall, widely distributed in sub-Himalayan ranges of India, North East and South West Africa, Sri Lanka, Arabia and Madagascar. Pods are pendulous, triangular, brown, splitting lengthwise into three parts when dry, contains 20 seeds. Seeds are dark brown with three papery wings [57]. Seeds are given in venereal disease, neerthu pona vinhuth (low viscous semen), vinhuth thadipu (high viscous semen). Premature ejaculation, aphrodisiac [Table 1]. It consists of cysteine and methionine found to be close to that of human milk, cow’s milk and chicken egg [58]. Aqueous seed extract of *M. oleifera* at doses of 100, 200 and 500 mg/kg enhance sexual behaviour in male rats and also increased the sperm count [59].

**Madhuca longifolia**

*Family – Sapotaceae; Figure 6*

Synonyms: South Indian Mahua (Eng), Iluppai (Tamil), Madhursav, Gudapushpa (Sanskrit) [11]. *Madhuca longifolia* is a large evergreen tree distributed in India, Nepal and Sri Lanka [60]. Flowers are stalked, creamy-white corolla, many stamina, hairy ovary, style long [61]. Flowers are given in low semen count, blood purifier [62] in boosting the quantity of seminal fluids [60] and has aphrodisiac action [Table 1]. Consist of arginine, iron, calcium, potassium, phosphorus, Magnesium and sodium [63]. Dried flowers are used in the production of alcohol which preserves the drugs. Promotes the extraction of active components from plant materials and absorbs the active components from the gastrointestinal tract [64].

**Cuminum cyminum**

*Family – Apiaceae; Figure 7*

Synonyms: Cumin (Eng) Cheerakam (Tamil), Ajaja (Sanskrit) [11]. The cumin is an annual plant, small and tender growing to a height of 30 cm. Originates from the Mediterranean area, Syria, Egypt and grows extensively in Iran and Turkey. Frequently referred to in the bible, mainly by Mathew and Isaiah in reference to its use as tithe. The fruit well known as cumin seed is yellow to brownish-grey, extended in shape with nine protuberances [65]. Fruit are given in testicle swelling, regulating infertility [66] acts as stimulant of the sexual organs [65] has aphrodisiac action and cooling effect [Table 1]. It consists of cymene, cuminol, carvone, cuminaldehyde and terpene [67]. 0.25 g/kg p.o of *Cuminum cyminum* to alloxan diabetic rats for six weeks showed reduction in blood glucose and increase in total haemoglobin level [68]. Reported to have antioxidant and antistress activity [69].
**Maerua arenaria** Hook. f. & Th. (Family – Capparidaceae; Figure 8)

Synonyms: Earth sugar root (Eng), Bhumichakkarai (Tamil), Piluparni, Madhusravaa (Sanskrit) [11]. *Maerua arenaria* is a woody twining straggler distributed in the dry forests of South India. Roots are identified by the presence of peripherial vascular bundles in the outer stele region [70]. Root tubers are traditionally given in sterility [71] thathu viruthi (increases sperm) [Table 1] and has aphrodisiac action[72].Consists of phytoestrogens, alkaloids, saponins, glycosides, carbohydrates and amino acids [70]. The aqueous extract at the dose of 800mg/kg p.o showed significant reduction in blood glucose [73].

**Cinnamomum verum** Persl. (Family – Lauraceae; Figure 9)

Synonyms: Cinnamon, Ceylon Cinnamon (Eng), Elavangappattai (Tamil), Varaanga, Daarusitaa (Sanskrit) [11]. *Cinnamomum verum* is native to South India and Sri Lanka. The cinnamon is the dried inner bark of the tree [74]. Bark is given in aanmai peruki (aphrodisiac), thatunattam (Oligospermia) [Table 1]. Cinnamon shows high antioxidant activity [74]. The active substance are eugenol and cinnamaldehyde [75]. Bark extract showed a significant increase in sperm count, sperm motility and reproductive organ weights [76].

**Cinnamomum tamala** Nees & Eberm. (Family – Lauraceae; Figure 10)

Synonyms: Indian Cassia (Eng), Lavangappattiri (Tamil), Tamaalpatra (Sanskrit) [11]. The tree is widely distributed in Asia, South America, Australia, Pacific region and India. A tree produces on an average of 10-25 kg of dry leaves. The leaves have been used in traditional medicines as a stimulant, astringent, cardiac disorder and diabetes [77]. Given in low vitality [78] thathunatam (oligospermia) [Table 1]. Main component is eugenol [77]. Reported to have anti-hyperglycemic [79] and immunomodulatory activities [80].

**Syzgium aromaticum** (Linn.), Eberm. (Family – Myrtaceae; Figure 11)

Synonyms: Clove (Eng), Kiraambu, Lavangam (Tamil), Lavanga (Sanskrit) [11]. *Syzgium aromaticum* an evergreen tree indigenous to India, Indonesia, Zanzibar, Mauritius and Ceylon. Grows up to 10–20 m in height [81]. Given in sukilanashtham, Shena vinthu (Oligospermia), Aphrodisiac [Table1] prevent premature ejaculation. Minerals present are iron, selenium, potassium, manganese, and magnesium [82]. Chemical constituents are eugenol, eugenol acetate, eugenin, carophyllene, apigenin, triterpene, tannins, benzaldehyde, quercetin and kaempferol [83]. Hexane extract of flower buds at lower dose of 15 mg/kg p.o increased the serum testosterone level [84]. 50% of Hydro alcoholic extract of clove exhibited aphrodisiac activity in mice [83].

**Vitis vinifera** Linn Ebern (Family – Vitaceae; Figure 12)

Synonyms: Wine Grape (Eng), Draksha (Tamil), Kishmish, Draakshaa (Sanskrit) [11]. *Vitis vinifera* is native to Western Asia and southern Europe [85]. Therapeutically given in sukila viruthi (increases sperm), Anmai kuraivu (sexual debility), Aphrodisiac, enriches blood, immunostimulant [Table 1] stress related disorders, cardiovascular diseases and antiglucose. Its antioxidant property may be due to polyphenols, flavonoids, procyanidins, anthocyanins, proanthocyanidins and resveratrol [86].

**Bombax ceiba** Linn (Family – Bombacaceae; Figure 13)

Synonyms: White Silk cotton tree (Eng), Ielavampisin (Tamil), Mocharas (Sanskrit) [11]. Widely distributed in Indian forest up to a height of about 1500m. Gum is light brown in colour similar to the galls and slowly becomes opaque dark brown [87]. It is known as Sukila bandhini for the reason that it keeps the semen in suspension [2].Given in spermatorrhoea, sukilanbalapadum (gives strength to semen),vinthu undakum (sperm production), aphrodisiac [Table 1] sterility, impotency and nocturnal emission [88]. Contains gallic and tannic acid, D-glucose, D-galacturonic acid, L-arabinose and aldobiuronic acid. [87]. It showed the antioxidant activity [88].

**Costus speciosus** (Koen.) Sm. (Family – Costaceae; Figure 14)

Synonyms: Wild Ginger (Eng), Kottam (Tamil), Kebuka, Kembuka (Sanskrit) [11]. *Costus speciosus* is an erect plant grows up to 2.7 m high, native to the Malay Peninsula of Southeast Asia. Root stock is tuberous (89). Given in aphrodisiac, thatunattam, veeriya nashtam (oligospermia) [Table 1 ] spermatorrhoea [90]. Costunolide and eremanthin have normoglycemic activity in streptozotocin-induced diabetic rats [91]. Contains antioxidants like phenol, flavonoids, ascorbic acid, glutathione, β-carotene and α-tocopherol [92]. It is a natural source of diosegenin which is a precursor in the synthesis of steroidal hormones and hence gained importance in the drug industry [93].Antistress activity is reported [89].

**Mesua ferrea** Linn. (Family – Guttifereae; Figure 15)

Synonyms: Iron wood (Eng), Sirunagappo (Tamil), Naagapushpa, Naagakeshara (Sanskrit) [11]. Native to SriLanka. Also cultivated in India, southern Nepal, Myanmar Peninsula and Indochina [94]. Flowers contain white petals with center of numerous yellow stamens [95]. Flowers are therapeutically given in vinthu nashtam (oligospermia), male gonorrhoea, impotency and has aphrodisiac action [Table 1]. The active compounds are Mesuferon, Mesuanic acid, Mammeisin, Mesugin and Sitosterol [96]. Ethanolic extract showed antioxidant activity [94].

**Glycyrrhiza glabra** Linn (Family – Leguminaceae; Figure 16)

Synonyms: Liquorice (Eng), Athimathuram (Tamil), Atrisasaa, Madhurasaa (Sanskrit) [11]. Liquorice is native to Asia and Mediterranean. Soft and fibrous main taproot with bright yellow interior colour [97]. Root is used in sexual debility [98] prostate...
enlargement[99] erectile dysfunction[100] infertility [101] a plastic anemia [102] spermatorrhoea [66] thatnutam, thatu sheena rothi (Oligospermia) and has aphrodisiac action [ Table 1]. Bio active constituent are glycyrrhizin, glabrin A&B, glabrolide, isoglaborolide, glycyrrhetol, glycyrrhizinic acid, triterpenoids, saponin, triterpene sterols, isoflavones and coumarins [103]. Has antioxidant activity [97]. The aqueous root extract showed immunomodulatory activity [102]. Extract possess radio-protective effects and antidepressant activity [104]. Licochalcone-A inhibits growth and spread of androgen-refractory prostate cancer [105]. The extract exhibited aphrodisiac activity at the dose of 150 and 300 mg/kg p.o for 28 days in rats [39].

**Phoenix dactylifera Linn (Family – Arecaceae; Figure 17)**

Synonyms: Date palm (Eng), Perichchankay (Tamil), Kharjuuraka ( Sanskrit ) [11]. Phoenix dactylifera is native to Arabian Gulf countries and considered as an important food in North and Middle East African countries [106]. Fruit is a one-seed berry with fleshy mesocarp enclosed by a thin epicarp. Seed is surrounded by a hard endocarp [107]. Dry fruit is given in impotence, infertility, diabetes and has aphrodisiac action [Table 1]. Dates counteract alcohol intoxication [106]. Fruit pulps are rich in iron, calcium, copper, magnesium, cobalt, fluorine, phosphorus, manganese, potassium, boron, sodium, sulfur, selenium and zinc [108]. Contains flavonoid and estradiol which have positive effects on the quality of sperm [109]. Polysaccharides and polyphenols stimulate the cellular immune system in mice [110]. Crude aqueous and methanolic extract have a stimulatory effect on the bone marrow tissue for the haemopoietic activities [111]. Aqueous extracts of dates were shown to have potent antioxidant activity [112]. Aqueous extract ameliorates the effect of Atrazine testiculotoxicity which is evidenced by the reduction in lipid peroxidation, improved sperm characteristics and testicular oxidative enzymes [106].

**Myristica fragrans Houtt (Family – Myristicaceae; Figure 18)**

Synonyms: Nutmeg, Mace (Eng), Jaathikkai (Tamil), Jaatiphaala, Jaatishasya ( Sanskrit ) [11]. Myristica fragrans is a evergreen tree and grows to 10–20m in height. Distributed in India, Sri Lanka and Indonesia. Nutmeg is a dried kernel of broad ovoid seed [81]. Seed is given in spermatorrhoea, vinthu kuraivu, thatu nashtam, vinthu nattam (Oligospermia), impotency, has aphrodisiac action [Table 1] and increases blood circulation. 50% ethanolic extracts of Nutmeg in mice significantly improved sexual activity [81]. Its component such as Myristicin, Eugenol and Lignan has been reported to maintain antioxidant level. Seed extract reduces the deleterious effects of radiation on testis which is one of the extremely radiosensitive organ due to the cell renewal system [113].

**Bambusa aurundinaceae wild (Family – Poaceae; Figure 19)**

Synonyms: Spiny or Thorny Bamboo (Eng), Moongiluppu, Bamboo-manna (Tamil), Tvakkshi, Vanshalochana ( Sanskrit ) [11]. Bamboo is distributed in India except Indo-Gangetic Plain and Himalaya. The interior stalks of female plant contain silicious bluish white concretion known as tabashir [114]. It is the medicinal salt found in bamboo. It has stimulant, aphrodisiac and cooling effect [2]. Tabashir contains 90% of silica, potash, peroxide of iron, alumina, lime, vegetable matter, urease, cholins and cyanogenetic glycoside [114].

**Illicium verum Hook.f. (Family – Magnoliaeae; Figure 20)**

Synonyms: Star Anise (Eng), Takkola, Anasippo (Tamil) [11]. Star Anise is a medium sized tree distributed in Asia and is native to Vietnam and China. Fruit is a capsule, aggregate and is star shaped with radiating 5 to 10 pointed boat shaped sections. Fruits are picked before ripening and then dried. Seeds are shiny brown with high oil content [115]. Fruits are given in thathu viruthi (increases sperm) and aavu kuraivu (impotency) [ Table 1).The Major active compound is anethole. Reported to have antioxidant activity[115] and androgenic effect [116].

**Cyperus rotundus Linn (Family – Cyperaceae; Figure 21)**

Synonyms: Nut Grass (Eng), Koraikkizhangu (Tamil), Mustaka (Sanskrit) [11]. It is a common perennial grass-like herb typically grows from 7-40 cm tall. The rhizomes are white and fleshy, scaly leaves, fibrous, wiry and become dark brown when mature. Native to India [117]. The Rhizome is given in spermatorrhoea [67] thathu viruthi (increases sperm) and has aphrodisiac action [ Table 1]. Found to contain flavanol, glycoside, saponin, phenol, terpenoids and cardiac glycosides. Has antioxidant activity [117]. The Aqueous extract of C. rotundus showed the maximum prevention of testicular cell damage at the dose of 400mg/kg [118].

**Coscinium fenestratum Gaertn (Family – Menispermaeae; Figure 22)**

Synonyms: False Calumba (Eng), Maramanjal (Tamil), Harichandana (Sanskrit ) [11]. Tree Turmeric is widely distributed in Asia, Africa, India, Sri Lanka and Indochina region. The stem contains the major active compound berberine[119]. Stem bark has a tonic and astringent effect [Table1]. Given in diabetes mellitus [120] and anemia [66]. Alcoholic stem extract causes a significant increase in hepatic antioxidant enzymes which protects the cell against free radical damage and also shows significant reduction in blood glucose levels in normal and diabetic rats [119].

**Lawsonia inermis Linn (Family – Lythraceae; Figure 23)**

Synonyms: Henna (Eng), Maruthani (Tamil), Madayanti (Sanskrit ) [11]. Henna is a biennial herbaceous shrub native to South-West Asia and North Africa. Bark is greyish brown in colour. Older trees are with spine tip. Seeds are about numerous, smooth and pyramidal. The seed coat is hard and thick with brownish coloration. Henna symbolizes fertility. Seeds are deodorant and are used in dysentery, liver disorder [121] menorrhagia, vaginal discharge, and leucorrhoea [ Table 1]. Seeds contain carbohydrates, proteins,
fibers and fatty oils like stearic acid, behenic acid, oleic acid, arachidic acid, palmitic acid, and linoleic acid. Ethanol extract prepared from the powdered seeds of *L. inermis* failed to show any antifertility activity [121]. CNS depressant activity is reported [122].

**Adhatoda vasica Nees (Family – Acanthaceae; Figure 24)**

Synonyms: Malabar nut (Eng), Aadaathodai (Tamil), Vaasaka (Sanskrit) [11]. It is a sub-herbaceous bush, native to India, grows in open plains, mainly in the lower Himalayas up to 1300 meters beyond sea level. Spread from the Punjab in the North, Assam and Bengal in the South-East to the Ceylon, Malaysia and Singapore in the South [123]. The fruit which holds the most potential of the herb is a small capsule usually with four seeds [124]. Alkaloids found in defatted seeds were vasicine, vasicinone and vasicinol [66]. Ethanolic extract of *A. vasica* leaf at a dose of 800 mg/kg p.o for 15 days prevented radiation-induced chromosomal damage in bone marrow cells, which suggests its significant radio-protective effects on the testis [125].

**Alternanthera sessilis Linn (Family – Amaranthaceae; Figure 25)**

Synonyms: Sessile joy weed (Eng); Ponnonkanni keerai (Tamil) Matsyaakshi (Sanskrit) [11]. Grows abundant in America, Africa and India. Seed is inverted, orbicular, ovate and compressed [126]. Shoot with other ingredients restore virility [5]. Root is given in spermatorrhoea [127]. Seed oil contains ricinoleic, myristic, palmitic, stearic, oleic and linoleic acid [128]. The genus finds potential claim in immunomodulator activity [126].
DISCUSSION AND CONCLUSION

Synergistic features are unique to phytotherapy and it contributes both to efficacy and safety [129]. In CKC shilajit act as the synergistic enhancer of other drugs. Zinc, selenium, copper, manganese, nickel, protein, carnitine, arginine, fatty acid, vitamin A, B12, B9, E, are required for successful reproduction. Ca, Cu and Mg are involved in sperm motility [130], iron in spermatogenesis [131] and amino acids in sperm activity [132]. Steroidal constituents like sterols, glycoside and saponins increase the steroidogenesis [133, 137]. Tannis, flavonoids and phenol shows antioxidative property [7, 133-135]. These phytochemicals and minerals were identified to justify the spermatogenic activity of CKC. Traditional uses of the ingredients of CKC claims its indication in treating spermatorrhoea, male infertility, impotency, premature ejaculation, oligospermia, nocturnal emission, anaemia, thyroid disorder, low and high viscous semen, testicle swelling, male gonorrhoea and prostate enlargement. Some drug has aphrodisiac action, act as testosterone booster, male vitality and virility enhancer, increases the semen and some counteract alcohol intoxication. Curculigo orchioides treats sexual dysfunction following hyperglycemic stress and it also protects the reproductive organs from heat induced sexual dysfunction. TT is effective in men with anti-sperm antibodies and to increase the levels of testosterone. Clinical studies on TT have exposed positive effects in the patients suffering from erectile dysfunction and hypogonadism. TT extract had exhibited aphrodisiac activity in normal and castrated mice and also in aged and sluggish males in the clinical setting. It had offered a protecting effect against Cd-induced testicular damage in rats. Mucuna prurieta exhibited inhibition of hyperprolactinemia in man. It improved the semen quality and corrected the fructose level in seminal plasma of infertile men. It is successful in combating the stress mediated compromise in spermatogenesis. It produces quality sperm and the sperm extracted can be used for in vitro fertilization procedures. It reverses the oestrogen mediated loss of testicular homeostasis and spermatogenesis and also decreases sperm damage in ageing. Fulvic acid in Shilajit helps to absorb iron into the body and makes it bioavailable to bone marrow stem cells for blood formation. The spermatogenic activity of Shilajit is reported in rats. HPLC analysis showed that the treatment with Processed Shilajit for 90 days caused inclusion of the major constituents into the semen. Moringa oleifera is given in both low and high viscous semen so as to maintain normal viscosity. Aqueous extract of M. oleifera seed improved sexual behaviour and also significantly increased the sperm count in male rats. Madhuca longifolia is given to boost the quantity of seminal fluids. Cinnamomum verum extract showed a significant increase in reproductive organ weights, sperm count and motility. Hexane extract of flower buds of S. aromaticum increased the serum level of testosterone. S. aromaticum, G. glabra, M. fragrans and Bombax ceiba demonstrated to have aphrodisiac activity. Aqueous extract of Phoenix dactilifera ameliorates the effect of Atrazine testiculo toxicity. Deleterious effects of radiation in

Anatomical parts of the herbs and mineral used in the preparation of CKC.
the testis are reduced by *M. fragrans* seed extract. The Aqueous extracts of *Cyperus rotundus* showed the maximum prevention of testicular cell damage. In conclusion it is observed that the herbs and mineral present in Chandrakanthi choornam strongly justify its effectiveness in treating oligospermia. Both safety and efficacy proved in preclinical studies and clinical trial (unpublished) and the outcome obtained provide it as a right treatment modality for oligospermic patients by improving sperm parameters.

**Authors’ Statements**

**Competing Interests**

The authors declare no conflict of interest.

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