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ANTIFERTILITY ACTIVITY OF MEDICINAL PLANTS ON MALE AND FEMALE REPRODUCTION

Parveena Devi [1], Pradeep Kumar [2], Nidhi [3] and Isha Dhamija*[1]

P. D. M. College of Pharmacy [1], Bahadurgarh, Haryana, India
Department of Zoology [2], Department of Pharmaceutical Sciences [3] Maharshi Dayanand University, Rohtak, Haryana, India

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Correspondence to Author:

Isha Dhamija
Assistant Professor
P.D.M. College of Pharmacy
Sector-3 A, Sarai Aurangabad,
Bahadurgarh, Haryana - 124507
India
E-mail: ishaa25@gmail.com

ABSTRACT: Population control is a significant issue worldwide especially in developing countries like India. Population breakout has responsible for various deleterious effects on life surviving resources on the earth. Therefore fertility regulation is necessary for the conservation of life supporting resources as well as good reproductive life of both males and females. Various chemical methods of contraception are available today but these methods possess several side effects. Herbal medicinal plants have been used as safe alternatives of the chemical methods. Evaluation of the herbal medicinal plants has been in progress for several decades to identify effective and safe substances for fertility regulation. Several medicinal plant extract were investigated for their antifertility activity both in male and female animal models. This review covered scientific proven information on various medicinal plants used for antifertility activity in both males and females. This review provides information on botanical name along with their common name, antifertility activity, part used and their phytochemicals present in plants.

INTRODUCTION: Fertility control is a significant issue of global and national public health concern. Ever increasing human population throughout the world particularly in developing and underdeveloped countries has inevitable effects on the life supporting resources on the earth and also detrimental effects on all aspects of development especially employment, education, housing, health care, sanitation and environment [1, 2]. In 2005 G.C., world population is estimated to be 6.5 billion. The number is expected to increase by 2.5 billion over the next 45 year, 6.5 billion to 9 billion in 2050. The developing countries absorbed 95% of all population growth and only 5% contributed by the developed world [3]. Population explosion is one of the serious problems in developing countries like India that would be increased about 9.2 billion by the year 2050. The census of 2005 showed that the growth rate of population in India during the previous 10 years was about 1.5%. Annually, around 18 million people are adding to our total population which leads to an extra burden on the community and finally responsible for poverty and pollution in developing countries [4].

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Due to all these detrimental effects, fertility regulation comprising contraception and management of infertility forms an important component of reproductive health for both male and females [5]. Several effective approaches for the induction of infertility have been investigated over a long period including hormonal, chemical and

immunological approaches [1]. The chemical approaches possess various side effects like obesity, cholethiasis, gastric trouble and carcinoma of breast and cervix, asthma and thromboembolism which decrease their popularity and utility among women. The hormonal contraceptives also have carcinogenic effects. Therefore, now a days, plant products catches the attention of many scientists as a primary source of naturally occurring fertility regulating agents because of their little and no side effects [4]. Higher use of contraceptives methods is a direct indicator of health, population development and women empowerment [6]. Several herbal plants possess different types of antifertility activities both in males and females [7].

Some herbal plants exhibiting potent antifertility activity for males:

1. *Gossipium herbaceum*:

Common name: Levant cotton

Family: Malvaceae

Chemical constituents: It contains Gossypol (yellow colour phenolic compound), sugar, gum, tannins and fixed oil[1].

Activities:

i. It reduced the level of serum testosterone and luteinizing hormone in dose dependent manner [8].

ii. It induced the azoospermia or oligospermia by directly acting on the testis [9].

iii. It was found that it inhibits sperm motility by blocking the cAMP formation in the sperms [10].

iv. It was acts on the pituitary gonadal axis and decreased the secretory activity of accessory sex glands [11].

v. It inhibited T-type Ca^{2+} currents in mouse spermatogenic cells [12].

Type of extract used: Root bark tincture was showed male conceptive activity.

Animal models: Hamester [13] and rats[14, 15] were used for finding the male contraceptive potential of *Gossipium herbaceum*.

2. *Carica papaya:*

Common name: Papaya

Family: Caricaceaea

Chemical constituents: It contains papain, chymopapain, pectin, carposide, carpaine, pseudocarpaine, dehydrocarpines, carotenoids, cryptoglavin, cis-violaxanthin and antheraxanthin [7].

Activities:

i. It suppressed cauda epididymal sperm motility and also reduced the sperm count without influencing libido of animals[16].

ii. It induced long term reversible azoospermia [17].

iii. It also caused sterility in rats due to total suppression of sperm motility [18].

iv. It was also caused degeneration of germinal epithelium and germ cells, reduction in the number of leydig cells and vacuoles in the tubules [19].

v. It altered cauda epididymal microenvironment [20].

vi. It was also reduced the contractile responses of cauda epididymal tubules and retarded the sperm transport in cauda epididymus [21] and also caused ultrastructural changes in testis and epididymus of rats [22].

Type of extract used: Aqueous, benzene and chloroform extracts of papaya seeds used for reversible antifertility action [7].

Animal models: Male rats were used for investigating the antifertility action of papaya seeds [7].

3. *Hibiscus rosasinensis:*

Common name: Gudhal

Family: Malvaceae

Chemical constituents: It contains steroids, tannins, saponins and flavonoids [23].

Activities:

i. It possessed antispermatogenic and antiandrogenic activity [24, 25, 26].

Type of extract used: 50% ethanolic extract, benzene and benzene/ether extract of flowers were showed antifertilty activity [24, 25, 26].

Animal models: Rats [25], Nonscrotal bat [24] and mice [26] were used for demonstrating the above mentioned antifertility activity of *Hibiscus rosasinensis*.

4. *Andrographis paniculata:*

Common name: Kirayat

Family: Acanthaceae

Chemical constituents: It contains flavonoids, andrographilode, diterpenoids, phenylpropanoids, oleanolic acid and β-sitosterol [27].

Activities:

i. It caused cessation of spermatogenesis, degeneration in seminiferous tubules and regression of leydig cells. Degeneration had also been seen in accessory sex organs and its fluid content [28].

ii. It was prevented cytokinesis of the dividing spermatogenic cell lines.

iii. It also caused decrease in sperm motility and sperm count and also provides abnormalities in sperms [29].

Type of extract used: Dry leaf powder was generally used at the dose of 20 mg powder/day/rat.

Animal models: Rats were used for identifying the antifertility efficacy of *Andrographis paniculata.*

5. *Tripterygium wilfordii:*

Common name: Thunder god vine

Family: Celastraceae

Chemical constituents: It contains Triptolide (diterpene epoxide), Tripchlorolide and glycosides.

Activities:

It caused degenerative changes in seminiferous tubular epithelium and decrease in plasma testosterone [30].

It was inhibit the Ca^{2+} channel activity in mouse spermatogenic cells [12].

It also caused severe impairment in cauda epididymal sperm [31, 32].

Type of extract: Crude extract of roots was showed antifertility action.

Animal models: Rats and mice [33] were used.

***6. Solanum surattense* :**

Common name: Kateli

Family: Solanaceae

Chemical constituents: It contains sterols, alkaloids (solasodine), saponins, flavonoids and glycosides [34].

Activities:

i. It caused disruptive changes in the acrosomal membrane of sperm and arrest spermicidal motility [35].

ii. It was also cause degenerative changes in seminiferous epithelium and spermatogonic elements [36].

Type of extract used: 50% ethanolic extract of roots [36], alcoholic extract of seeds [37] were utilized.

Animal models: Male rats [36] was used for checking the antifertility potential of *Solanum surattense.*

7. *Embelia ribes:*

Common name: Laksmana, amalaki

Family: Myrsinaceae

Chemical constituents: It contains alkaloids, quinine, proteins, saponins, triterpenes, coumarins, resins, tannins and Embelin (2, 5-dihydroxy 3-undicyl-1, 4-benzoquinone) [38, 39].

Activities:

i. It was affected the sperm motility, quantity and quality of semen and lowered the hormonal level [40].

ii. It produced profound morphological and histological changes in testis [38, 41].

Type of extract used: Extract of berries was used as a fertility regulating agent.

Animal models: Male bonnet monkeys [40] were utilized.

8. *Stephania hernandifolia:*

Common name: Aknadi

Family: Menispermaceae

Chemical constituents:

i. It contains alkaloids (hernandin, hernsubanine), proteins and tannins [42].

Activities:

i. It showed deminution of the activities of testicular androgenic key enzymes and plasma testosterone with spermatogenesis [43].

Type of extract used: Aqueous extract of leaf was used.

Animal models: Rats [43] were used for demonstrating the antifertility activity of *Stephania hernandifolia.*

9. *Catharanthus roseus:*

Common name: Sadabahar

Family: Apocynaceae

Chemical constituents: It contains tannins, steroids, saponin glycosides, cardiac glycosides, anthraquinone glycosides and flavonoids [44].

Activities:

ii. It produced pathological changes in the principle and apical cells of caput and nuclear cells of cauda causing impairment of epididymal functions [45].
iii. It affected spermatogenic cell lines other than spermatogonia [46, 47].

Type of extract used: Extract of leaf [47] was used for carried out male contraception.

Animal models: Male rats [47] were used for investigating the male conception activity of *Catharanthus roseus.*

10. *Abrus precatorius:*

Common name: Indian liquorice, chirmi

Family: Fabaceae

Chemical constituents: It contains glycosides, alkaloids, tannins and flavonoids [48].

Activities:

i. In Srilanka, ayurvedic physicians have been claimed that seeds of A. procatorius inhibit conception in humans when taken orally [48].
ii. It altered the sperm morphology, reduced sperm motility and metabolism [49].
iii. It reduced testicular weight and sperm count and also causes degeneration in the testis during the later stages of spermatogenesis [50].

Type of extract used: 50% ethanolic extract of seeds was used for antifertility action in males [50].

Animal models: Rats[51, 52], rabbits and presbytis monkeys[53] were used for finding the above mentioned activities.

11. *Azadirachta indica:*

Common name: Neem

Family: Meliaceae

Chemical constituents: It contains flavonoids, saponins, phenols and chymophenols [54].

Activities:

i. It caused disturbances in the structure and functions of testis and spermatozoa [54].
ii. It also produced histopathological and biochemical changes in the caput and cauda [55].
iii. It reduced the serum testosterone level [55].
iv. It produced mass atrophy in spermatogenic elements [56] and arrested the spermatogenesis stage (late XII).
v. It caused morphological changes in the head of the sperm and its acrosome due to androgen deficiency [57].
vi. It was also showing the spermicidal activity [58].

Type of extract: Seed oil [59], Neem oil [60] and ethanolic extract of leaves [61] were established for male infertility.

Animal models: Rats [62, 59, 63], mouse [60], monkeys [64] and humans [64] were used for evaluating the antifertility activity in males.

12. *Aegle marmelos:*

Common name: Bael fruit tree

Family: Rutaceae

Chemical constituents: It contains marmin, fagarine, skimmianine, aegelin, lupeol, citral, cineol, citronella, cumin aldehyde, eugenol and marmesinine [65]. Marmin and fagarine is especially responsible for male infertility.

Activities:

i. It was significantly reduces the reproductive organs weight and serum testosterone level [66].

ii. (It also reduced sperm density, motility, viability and sperm acrosomal integrity [67, 68, 69].

iii. It was also responsible for exfoliation of elongated spermatids, nuclear chromatin condensation, degeneration and prominent spaces detected within the germinal epithelium which indicated testicular cytotoxicity and necrosis [6].

Type of extract used: Methanolic extract of aegle marmelos bark, leaves, seeds and fruits were used for male infertility [67, 68, 69, 6].

Animal models: Rats [6] were used as preclinical model for evaluating the antifertility activity in males.

13. *Apium graveolens:*

Common name: Celery

Family: Apiaceae

Chemical constituents: It contains essential oils, sesquiterpenes, flavonoids, coumarins and furocoumarins [70].

Activities: It arrested spermatogenesis as well as decrease sperm count, sperm motility, blood testosterone concentration, weight of testes and seminal vesicles and diameter and viability of seminiferous tubules [70].

Type of extract used: Ethanolic extract of *Apium graveolens* seeds was administered for male infertility [70].

Animal models: Rats [70] were used for evaluating the antifertility activity of *Apium graveolens*.

Some herbal plants exhibiting antifertility activity in females:

Several medicinal plants associated with antifertility activity in females are exists in India. These plants produce antifertility activity by acting through various mechanisms:

(a) Estrous cycle disruptors

(b) Anti-estrogenic agents

(c) Anti-implantation agents

(d) Abortifacient agents

Estrous cycle disruptors:

1. *Rivea hypocrateriformis:*

Common name: Night glory, vaividang

Family: Convolvulaceae

Chemical constituents: It contains alkaloids, glycosides, saponins, tannins and phenolic compounds [71].

Activities:

i. After administration of extract, the level of cholesterol increased due to the inhibition of steroidogenesis.

ii. The myometrium and endometrium thickness and diameter were found to be increased indicating the uterotrophic effect.

iii. The number of graffian follicles declined and increased in number of atretic follicle indicating antiovulatory effect [72].

Type of extract used: Ethanolic extract of *Rivea hycrateriformis* at dose level of 200-400 mg/kg/body weight in rats [72] disrupts the estrous cycle.

Animal models: Rats were used to explore the antifertility potential of *Rivea hypocrateriformis* [72].

2. *Momordica charantia:*

Common name: Bitter melon, karela

Family: Cucurbitaceae

Chemical constituents: The principle phytochemicals which causes antifertility are steroids, triterpinoids, reducing sugars, sugars, alkaloids, phenolic compounds, flavonoids and tannins [73].

Activities:

i. It exhibited irregular pattern of estrous cyclicity and increases the length of estrous cycle [74].

ii. The disruption of the estrous cycle was found to be executed by disturbance in ovarian function and estrous cyclicity through interplay of ovarian and extraovarian hormones [74].

iii. It may be inhibiting the estrogen production or competing for its receptor [75].

Type of extract used: Methanolic extract of *Momordica charantia* seeds caused disturbances in the estrous cycle [74].

Animal model: Rats [74] were used for evaluating the female antifertility activity of *Momordica charantia.*

3. *Aspilia Africana:*

Common name: wild sunflower

Family: compositae

Chemical constituents: The phytochemicals are saponins, tannins, flavonoids and cardiac glycosides [76].

Activities:

i. It caused the alteration in estrous cycle by the prolonged proestrous and a reduced diestrous and estrous phase [77].

ii. It reduced the number of ova observed in oviduct [77].

iii. It caused the inflammation of the fallopian tube, degeneration in the ovarian cortex in the stroma cells of the ovary [77].

iv. It also caused the disruption of the endometrium of the uterus[77].

Type of extract used: Extract of *Aspilia africana* leaves was used for antifertility action [77].

Animal models: Rats [77] were utilised for finding the antifertility activity of *Aspilia africana*.

4. *Anethum graveolens*

Common name: Dill, sowa

Family: Umbelliferae

Chemical constituents: It contains tannins, glycosides, saponins, steroids, terpenoids and reducing sugars [78].

Activities:

i. It increased the duration of diestrous phases and total time of the estrous cycle [79].

Type of extract used: Ethanolic extract of Anethum graveolens was administered as estrous cycle disruptor [79].

Animal models: Rats [79] were used for demonstrating the antifertility activity of *Anethum graveolens.*

5. *Cissampelos pareira:*

Common name: Abuta, harjeuri

Family: Menispermaceae

Chemical constituents: Phytochemical analysis showed the presence of terpenoids, alkaloids, tannins, amino acid proteins and carbohydrates[80].

Activities:

ii. It altered the estrous cycle pattern and prolonged the length of estrous cycle with significant increase in the duration of diestrous stage [81].

iii. It also altered the secretion of luteinizing hormone (LH), follicle stimulating hormone (FSH), prolactin and estradiol [81].

Type of extract used: Extract of Cissampelos pareira leaves were used for antifertility activity [81].

Animal models: Rats [81] were used for checking the antifertility activity of *Cissampelos pareira* leaves.

6. *Curcuma longa:*

Common name: Haldi

Family: Zingiberaceae

Chemical constituents: Phtochemical analysis revealed the presence of flavonoids, aminoacids and alkaloids [82].

Activities:

i. It caused the suppression of ovulation by the inhibition of estrous phase [83].

ii. It showed anti-estrogenic activity which either block the estrogen receptors or diminishing the estrogen synthesis due to decrease in cholesterol metabolism [83].

Type of extract used: Extract of *Curcuma longa* was used for the suppression of estrous cycle [83].

Animal models: Rats [83] were used for investigating the female antifertility activity of *Curcuma longa.*

7. *Acacia leucophloea*

Common name: Reonja

Family: Mimosaceae

Chemical constituents: It contains tannins, flavonoids, terpenes and alkaloids [84].

Activities:

i. It increased the proestrous phase while estrous and metaestrous phase decreases [85].

ii. It caused decreases in the weight of ovary [85].

iii. It increased the cholesterol content [85].

Type of extract used: Alcoholic extract of *Acacia leucophloea* roots was used for estrous cycle disruptors [85].

Animal models: Rats [85] were used to evaluate the antifertility activity of *Acacia leucophloea.*

Anti-estrogenic agents:

1. *Butea monosperma:*

Common name: Flame of the forest, dhak

Family: Fabaceae

Chemical constituents: It contains glucose, glycine, glycoside and an aromatic hydroxyl compound [86].

Activities:

i. It was significantly reduces the weight of the ovaries and increases the level of cholesterol [87].

ii. It inhibited the activity of G-6-PDH indicating anti-steroidogenic activity [87].

Type of extract used: Petroleum ether and chloroform extract of *Butea monosperma* roots were used for antifertility action [87].

Animal models: Mice [87] were utilised for finding the antifertility activity of *Butea monosperma* extract.

2. *Piper bitle:*

Common name: Betel leaf, paan

Family: Piperaceae

Chemical constituents: It showed the presence of carbohydrates, alkaloids, gums, oils, steroids, glycosides, tannins, phenols, vitamins, organic acids and inorganic constituents [88].

Activities:

It showed anti-estrogenic activity by decreasing the weight of the ovary [89].

It reduced the circulating level of estrogen, fertility and number of litters [89].

It also caused decline in serum glucose concentration, enzyme activity of acid phosphatise, SGOT and SGPT and increment in the level of cholesterol and ascorbic acid [89].

Type of extract used: Ethanolic extract of *Piper bitle* leaves showing anti-estrogenic activity [89].

Animal models: Rats [89] were used for evaluating the anti-estrogenic activity of *Piper bitle* .

3. *Cassia fistula:*

Common name: Golden shower, amaltas

Family: Caesalpiniaceae

Chemical constituents: It showed the presence of anthraquinone glycosides, flavonoids, phenolic compounds and carbohydrates [90].

Activities:

i. It showed strong anti-estrogenic activity in presence of a strong estrogen like estradiol valerate and significantly reduces the estrogen induced uterotrophic effect [91].

ii. It was also prevents pregnancy when extract administered to the mated female rats [91].

Type of extract used: Aqueous extract of *Cassia fistula* seeds was used for anti-estrogenic activity [91].

Animal models: Rats [91] were used to explore the anti-estrogenic potential of *Cassia fistula* seeds.

4. *Ocimum gratissimum:*

Common name: Tulsi

Family: Lamiaceae

Chemical constituents: It contains the presence of alkaloids, phenolics, glycosides, resins, steroids and tannins [92].

Activities:

i. It showed slight anti-estrogenic activity when given along with strong estrogen i.e. estradiol valerate [93].

ii. It declined the fertility index, number of uterine implants and live foetuses when administered in mated female rats [93].

Type of extract used: Acetone extract of *Ocimum gratissimum* stem was administered for anti-estrogenic activity [93].

Animal models: Rats [93] are used for finding anti-estrogenic activity of *Ocimum gratissium*.

Anti-implantation agents:

1. *Ficus religiosa*

Common name: Pipal

Family: Moraceae

Chemical constituents: Phytochemical screening revealed the presence of n-hexadecanoic acid, 9, 12-octadecadienoic acid, 9, 12, 15-octadecatrienoic acid and butyl 9, 12, 15-octadecatrienoate [75].

Activities:

i. It dereased the thickness of surface epithelium, diameter of uterine glands, diameter of gland cells and thickness of the layer of myometrium [75].

Type of extract used: An Extract of *Ficus religiosa* fruit was used for anti-implantation effect [75].

Animal models: Goat [75] was utilised for finding the anti-implantation activity of *Ficus religiosa.*

2. *Calotropis procera:*

Common name: Sodom apple, aak

Family: Asclipiadaceae

Chemical constituents: It contains alkaloids, flavonoids, tannins, saponins and cardiac glycosides [94].

Activities: (i) It possessed strong anti-implantation activity [95].

Type of extract used: Ethanolic extract of *Calotropis procera* roots was used for anti-implantation effect [95].

Animal models: Rats [95] were used to explore the female anti-fertility potential of *Calotropis procera.*

3. *Terminalia belerica:*

Common name: Baheda

Family: Combretaceae

Chemical constituents: It showed the presence of phytosterols, carbohydrates, flavonoids, phenolic compounds and tannins [96].

Activities:

ii. It caused loss of implantation due to anti-zygotic, blastocytotoxic or anti-implantation activity of *Terminalia belerica* [97].

Type of extract used: Ethanolic extract of Terminalia belerica bark was used for anti-implantation activity [98].

Animal models: Rats [98] were used for checking the anti-implantation activity of *Terminalia belerica.*

4. *Physalis alkekengi:*

Common name: Bladder cherry, kakanaj

Family: Solanaceae

Chemical constituents: It contains tannins, saponins, alkaloids, flavonoids and glycosides [99].

Activities:

i. It was act as antagonist of female sexual hormones i.e. estrogen and progesterone which involves in the maintenance of implanted embryo [97].

Type of extract used: Extract of *Physalis alkekengi* plant was given for inhibition of implantation [97].

Animal models: Rats [97] were used for investigating the anti-implantation activity of *Physalis alkekengi.*

5. *Leonotis ocymifolia:*

Common name: Sun-Bird flower

Family: Lamiaceae

Chemical constituents: It contains phenols, flavonoids, alkaloids, saponins, glycosides and tannins[100].

Activities:

i. It reduced the number of implants significantly [101].

Type of extract used: Ethanolic extract of *Leonotis ocymifolia* leaves were used [101].

Animal models: Rats [101] were used for finding anti-implantation activity of *Leonotis ocymifolia.*

6. *Alianthus excelsa*

Common name: Indian tree of heaven

Family: Simaroubaceae

Chemical constituents: It contains quassinoids, glaucarubinone, alianthin, β-sitisterol and malanthin [102, 103], 1-p-deoxy-13-formylalianthiol and alianthin [104, 105], excelsin, 13, 18-dehydroexcelsin, glaucarubin, glaucarbol, 13, 18-dehydro 15-isovalerate and trihydroxy triucal 7-ene [106, 107, 108, 109, 110, 111].

Activities:

i. It possessed strong anti-implantation activity [112].

ii. It increased uterine weight when administered with ethinyl estradiol indicating its significant anti-estrogenic activity [112].

Type of extract used: Hydroalcoholic extract of *Alianthus excelas* stem bark was given for its anti-implantation activity [112].

Animal models: Rats [112] were used for evaluating the anti-implantation activity of *Alianthus excelsa.*

7. *Atrabotrys odoratissimus:*

Common name: Nag champa

Family: Annonaceae

Chemical constituents: It contains hydroxy-9-methoxypeterocarpan, nonacosanoic acid 2', 3'-dihydroxypropyl ester, pentacosanoic acid 2', 3'-dihydroxypropyl ester and docosanoic [113].

Activities:
It possessed strong anti-implantation activity and also produced the disturbances in the duration of the various stages of estrous cycle [114].
It reduced the number of implantation sites[114].

Type of extract used: Benzene, ethanol and water extract of *Atrabotrys odoratissimus* leaves were used for causing infertility in females via anti-implantation activity [114].

Animal models: Rats [114] were used for evaluating the anti-implantation activity of *Atrabotrys odoratissimus.*

Abortifacient agents:

1. *Coriandrum sativum:*

Common name: Dhania

Family: Apiaceae

Chemical constituents: It showed the presence of carbohydrates, proteins, phenolic compounds, tannins and flavonoids[115].
Activities: (i) It caused significant decrease in progesterone level of serum on day-5 of progesterone indicating abortifacient activity[116].

Type of extract used: Aqueous extract of *Coriandrum sativum* seeds was used as abortifacient agent.

Animal model: Rats [116] were used to evaluate the abortifacient activity of *Coriandrum sativum.*

2. *Melia azedarach:*

Common name: Chinaberry

Family: Meliaceae

Chemical constituents: It contains alkaloids, tannins, saponins, phenols, glycosides, steroids, terpenoids and flavonoids [117].

Activities:

i. It caused loss of implantation [118].

ii. It was also significantly reduces myometrial thickness, uterine gland diameter, luminal diameter of uterine glands and luminal epithelium cell height [118].

Type of extract used: Extract of *Melia azedarach* seeds were used as abortifacient[118].

Animal models: Rats [118] were used for finding the abortifacient potential of *Melia azedarach*.

3. *Trianthema portulacastrum:*

Common name: Horse purslane

Family: Aizoceae

Chemical constituents: Phytochemical analysis showed the presence of alkaloids, flavonoids, saponins, phenolic compounds and terpenoids [119, 120].

Activities:

i. It possessed significant abortifacient activity [120].

ii. It also produced significant increases in uterine weight, diameter of the uterus and thickness of endometrium which indicates its mild anti-estrogenic activity [120].

Type of extract used: Extract of *Trianthema portulacastrum* was used for abortifacient activity [120].

Animal models: Rats [120] were utilised for finding the abortifacient activity of *Trianthema portulacastrum.*

4. *Balantis roxburghii:*

Common name: Desert date

Family: Zygophyllaceae

Chemical constituents: It contains alkaloids, saponins, tannins, flavonoids, phenolic compounds, gum and mucilage [121, 122].

Activities:

It showed significant abortifacient activity [121].

It was also significantly increases the uterine weight diameter of uterus, thickness of endometrium and height of endometrial epithelium [121].

Type of extract used: Ethanolic extract of *Balanties roxburghii* fruits was given for abortion [121].

Animal models: Rats [121] were used for evaluating the abortifacient activity of *Balanties roxburghii.*

5. *Cannabis sativa*

Common name: Hemp, bhang

Family: Cannabinaceae

Chemical constituents: It showed the presence of flavonoids, phenolic compounds, alkaloids, steroids, saponins, terpenoids, tannins and reducing sugars[123, 124].

Activities:

i. It was possessed strong abortifacient activity. It produced significant decrease in ovarian and uterine weight whereas non-significant increase in body weight [123].

ii. It also caused slight increment in serum progesterone level and decrement in serum estrogen level [123].

iii. The level of LH and FSH was found to be significantly reduced after administration of extract [123].

Type of extract used: Alcoholic extract of *Cannabis sativa* leaves was used for abortifacient effect [123].

Animal models: Rats [122] were used for finding abortifacient potential of *Cannabis sativa*.

CONCLUSION: This review summarized scientific proven literature about phytochemical constituents, antifertility activities and type of extract used of various herbal medicinal plants for

both males and females which being traditionally used. The present review also covered animal models used to explore the antifertility activity of the above mentioned plants. These herbal medicinal plants act as antifertility agents via various mechanisms in both males and females. Future research is also required to make preparation of these herbal plants in scientific manner to make them safe and effective.

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