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REVIEW ARTICLE **OPEN ACCESS**

A Review: Role of Medicinal Plants in Managing Population Concern

Kiran Bhagour[1], Dharmendra Arya[2], R.S. Gupta*
Reproductive Physiology Section, Centre for Advanced Studies,
Department of Zoology, University of Rajasthan, Jaipur – 302 004, India
1. kiranbhagour@gmail.com
2. dharmendraaarya25889@gmail.com

ABSTRACT
Growing human population is a serious concern all over the world, adversely affecting the society at many aspects such as development, health care, food resources and so on. Medicinal plants play an important role in the treatment of several diseases along with a positive role in the population management. At present, the application of these herbal remedies as a contraceptive measure is taken as an alternative over their synthetic counterparts because of its less side effect and lower cost. The current review present 25 plants possessing antifertility activity, reported in literature from 2011 to 2015. The review contains brief summary of experimental data of medicinal plants along with family name, part used and active constituents in a tabulated form. Current review might prove helpful for the researchers in finding a better contraceptive option; further preparations can be done by this in the terms of safety, acceptable quality and efficacy.
***Key words**: Antifertility; Herbal remedies; Active constituents; Contraceptive.*

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INTRODUCTION

Rapid human population growth is a major issue in all over the globe especially developing and underdeveloped countries. It is growing day by day and it is influencing human population in all issues such as development, education, employment, housing, health care, sanitation and environment.

According to World population clock the human population was 1 billion around 1810. Just 120 years afterward, the population was doubled to 2 billion people (1930). The number of people has risen from 4.4 billion people in 1980 to 5.8 billion today. According to the United Nations estimates, the people population of the globe is likely to reach 8 billion people in 2024 and rise to 14 billion by the end of next century [1].

Raising human population will cause several problems if the growing population is not controlled or checked [2] India decided for family planning to control growing population [3]. Several types of contraception methods were used for fertility control but there is various adverse effects produced by synthetic steroidal contraceptives thus there is a demand to replace these products by a better alternative. Herbal plants have been traditionally used for the treatment of several diseases in all over globe. Plant drugs are frequently considered to be less toxic and free from side effects than synthetic ones [4]. The investigation of plant constituents with development of an effective, reversible and safe male contraceptive represents a potential alternative approach to birth control from the existing available methods. The current review presents 25 plants of 25 families along with their active constituents and included a brief summary of experimental data which have been reported in various journals since 2011 to 2015. The list of plant is described briefly with their dose level, duration and significant results and table contains the botanical name, family, parts and solvent used for extract along with their active constituents

SUMMARY OF SOME MEDICINAL PLANTS WITH BRIEF DESCRIPTION-

India has an officially recorded list of 45,000 plant species among which approximately 7500 species are of medicinal importance [5]. Herbal plants have been used for therapeutic application from earliest time; the literature of Ayurveda, Unani and Homeopathy are largely based on plant. A literature survey revealed that there are many plants which possess antifertility activity both in males. Some herbal plants are described below which possess antifertility activity:-

***Acacia nilotica*:-** The aqueous extract of dried pods of *Acacia nilotica* was given to male Wistar rats at the dose of 200 mg/kg b.w. Result showed significantly reduction in Sperm motility, progressive motility and sperm *concentration* and testosterone level was also decreased in treated rats. Histopathology of reproductive organs showed that dose of *Acacia nilotica* disrupted semeniferous tubule architecture and spermatogenesis process. These studies indicate that aqueous extract of dried pods of *Acacia nilotica* has antifertility activity [6].

***Aegle marmelos*:-** The methanolic bark extract of *Aegle marmelos* was given to male albino rats at the dose of 200, 400 and 600 mg/kg b.w for 60 days. Result showed significantly reduction in serum testosterone, cholesterol levels and reproductive organ weight. Sperm concentrations, motility, sperm viability, acrosomal integrity were also decreased in treated rats. The study revealed that the methanolic bark extract of *Aegle marmelos* has potent antifertility activity [7].

***Alchornea cordifolia*:-** The aqueous roots extract of *Alchornea cordifolia* was given to pregnant female wistar rats at the dose of 100, 200 and 400 mg/kg b.w. Result showed significantly reduction in resorption sites at the dose level of 100 and 200 mg/kg and lack of implantation site was observed at the dose level of 400 mg/kg. The level of serum progesterone and weight of ovaries and uterine were decreased in treated rats. The study revealed that aqueous roots extract of *Alchornea cordifolia* could induce inhibitory effects on reproductive functions in female albino rats [8].

***Andrographis paniculata*:-** The aqueous leaf extract *Andrographis paniculata* was given to albino rats at the dose of 100 and 200 mg/kg b.w for 45 days. Result showed significant decrease in the weight of reproductive organ. A dose dependent reduction in testicular sperm count, epididymal sperm count and motility and abnormal sperm count were seen in treated rats. The study revealed that aqueous extract of the leaves of *Andrographis paniculata* has a potent spermicidal and antifertility agent [9].

***Calendula officinalis*:-** The ethanolic extract of *Calendula officinalis* was given to male albino rats at the dose of 150, 250 and 500 mg/rat/day for 60 days. Result showed significantly reduction in the level of glycogen, protein, sialic acid, fructose and Testosterone. The sperm motility and density of cauda epididymis and weight of reproductive organs were decreased. Thus, the study concluded that ethanolic extract of *Calendula officinalis* alters the fertility of rats [10].

***Caesalpinia pulcherrima*:-** The ethanolic extract of *C. pulcherrima* leaves was given to albino female mice at the dose of 200 and 400 mg/kg b.w. Phytochemical screening of plant extract showed presence of phytoconstituents such as flavonoid, tannins and glycosidase. Result showed a significant reduction in implantation activity in treated mice. Thus, the present study reveal that *C. pulcherrima* have a significant antifertility potential [11].

***Cordia dichotoma*:-** The hydroalcoholic extract of *Cordia dichotoma* leaves was given to female albino rats at the dose of 200 and 400 mg/kg b.w. Phytochemical screening showed the presence of glycosides, alkaloid, flavonoid, tannins, volatile and fixed oils. Result showed a significant anti-implantation activity at the high dose level in treated rats. The extract showed more significant increase in uterine weight and significant increase in estrogenic activity. Biochemical parameter such as serum cholesterol, total protein and alkaline phosphate was also increased. Therefore, the study revealed that hydroalcoholic extract of *Cordia dichotoma* possesses antifertility activity [12].

***Cyamposis psoralioides*:-** The ethanolic extract of pods of *Cyamposis psoralioides* (Guar gum) was given to male Swiss albino mice at the dose of 200 and 400 mg/kg b.w for 40 days. Result showed significantly reduction in the number of spermatozoa, weight of reproductive organs and level of serum testosterone. Histology showed reduction in the diameter of seminiferous tubules and diameter of the leydig cells. Thus, the study concluded that ethanolic extract of pods of *Cyamposis psoralioides* has a potent antifertility agent [13].

***Dioscorea villosa*:-** The ethanolic extract of *Dioscorea villosa* tuber was given to female albino rats at the dose of 100, 200 and 400 mg/kg b.w for 30 days. Phytochemical screening of the extract showed the presence of phytoconstituents such as alkaloid, saponin and flavonoid. After extract treatment, level of serum progesterone, serum estradiol was reduced significantly while level of FSH was increased. From the obtained data, it may be concluded that the extract of *Dioscorea villosa* tuber would have adverse effect on maturation and ovulation of follicles [14].

***Elytraria acaulis*:-** The methanolic extract of whole plant of *Elytraria acaulis* was given to male albino rats at the dose of 200 and 300 mg/kg b.w for 21 days. Result showed a significant reduction in the weight of reproductive organs and sperm count, motility. The serum level of cholesterol, triglycerides was

increased and glucose, protein level was decreased in the treated rats. Histology of testes of treated rats showed the loss of interstitium and degenerate germinal cells. Thus, these results indicate that the methanolic extract of *Elytraria acaulis* is a potential antifertility agent [15].

***Eugenia singampattiana*:-** The ethanolic extract of leaves of *Eugenia singampattiana* was given to male albino rats at the dose of 150 and 300 mg/kg b.w for 21 days. Result showed significantly reduction in epididymal sperm count, motility and levels of LH and testosterone. Serum urea, creatinine, serum levels of FSH, estrogen and the activity of liver marker enzyme (SGOT) was increased in drug treated rats. Present study concluded that, ethanol extract of leaf of *E. singampattiana* inhibited sperm concentration, motility and testosterone which might result in a male fertility [16].

***Feronia limonia*:-** The ethanolic extract of *Feronia limonia* fruit pulp was given to Wistar male albino rats at the dose of 250 and 500 mg/kg b.w once daily for 55 days. Result showed significantly reduction in epididymal sperm count, motility, and viability and increased per cent of abnormal sperm. A significant elevation was observed in testicular cholesterol and ascorbic acid content. The study revealed that *Feronia limonia* fruit pulp has reversible antispermatogenic and antisteroidogenic properties and could partially support traditional use as male contraceptive [17].

***Hibiscus rosa sinensis*:-** The benzene extract of flowers of *Hibiscus rosa sinensis* was given to male albino rats at the dose of 200 mg/kg b.w. Result showed significantly reduction in sperm count and sperm motility. Weight of body and reproductive organ such as testes and epididymes was decreased. The study revealed that the benzene extract of flowers of *Hibiscus rosa sinensis* has an antifertility activity [18].

***Hymenocardia acida*:-** The aqueous ethanolic extract of *Hymenocardia acida* was given to pregnant female albino rats at the dose of 100, 200 and 400 mg/kg b.w for 19 days. Result showed a significant reduction in the number of corpora lutea of pregnancy and number of live fetuses. The extract of plant affected significantly the weights of fetuses. Thus the present study revel that the ethanolic extract of plant has an antifertility and anti-implantation activity [19].

***Jatropha gossypifolia*:-** The petroleum ether, ethanol, and aqueous extracts of *Jatropha gossypifolia* leaves was given to female albino rats at the dose of 400 mg/kg b.w for 6 days. Phytochemical screening showed the presence of phytoconstituents carbohydrates, steroids, glycosides, flavonoid, tannins, and alkaloid in both ethanolic and aqueous extract. Ethanolic extract of plant showed significant increase in the height of luminal epithelium and loose and edematous stroma with stimulated uterine glands with increasing in estrogenic activity. Anti- implantation activity was also observed in treated rats. The result of present study indicates that *Jatropha gossypifolia* has a potential antifertility activity [20].

***Leptadenia hastate*:-** The aqueous extract of *L. hastate* leaves was given to male Wistar rats at the dose of 100,200,400 and 800 mg/kg b.w for 60 days. Result showed decrease of Leydig cells number and number of sperm in the testis and the cauda epididymis. Sperm parameters such as path velocity, progressive velocity, straightness, linearity and motility of spermatozoa were been significantly decreased. These results confirm the antiandrogenic effect of *L. hastata* and it claims that the consumption of the leaves reduced the fertility of animals [21].

***Madhuca latifolia*:-** The aqueous extract of *Madhuca latifolia* seed was given to male albino rats at the dose of 2 gm/kg b.w for 21 days. Result showed significantly reduction in the weight of testes, epididymis, seminal vesicle, coagulating gland, vasa deferens and ventral prostrate. Sperm count and Serum testosterone level. The study revealed that *Madhuca latifolia* has a potent antispermatogenic agent [22].

***Michelia champaca*:-** The hydroalcoholic leaf extract of *Michelia champaca* was given to female Wistar rats at the dose of 100 and 200 mg/kg b.w from 1 to 7 days of pregnancy and on 10^{th} day. Phytochemical screening of extract showed the presence of phytoconstituents such as steroids, flavonoid and alkaloid. The extract of plant showed estrogenic and antiimplantation activity. The study suggests that the extract of *Michelia champaca* possess antifertility activity [23].

***Polygala rosmarinifolia*:-** The ethanol extract of whole plant of *Polygala rosmarinifolia* was given to male albino rats at the dose of 100 and 200 mg/kg b.w for 14 days. Result showed a significantly reduction in the weight of the testes and epididymis and epididymal sperm count, motility and sperm abnormality were also decrease significantly in treated rats. Biochemical parameter such as serum protein, albumin, globulin, urea, creatinine and the activity of liver marker enzymes (SGOT, SGPT and ALP) levels were decrease. The hormonal assay of treated rats showed increased serum levels of FSH and estrogen but decreased in the serum levels of LH and testosterone. Hence, it concluded that, ethanol extract of whole plant of *Polygala rosmarinifolia* inhibited sperm concentration, motility and testosterone which might result in a male fertility [24].

***Psidium guajava*:-** The aqueous extract of *Psidium guajava* leaves was given to male albino rats at the dose of 250 and 500 mg/kg b.w. Result showed a Significant reduction of reproductive organs weight. The extract significantly reduced testosterone, total cholesterol concentration, triglycerides and HDL-

cholesterol concentration in the serum. These results confirmed that the aqueous extract of *Psidium guajava* has a contraceptive activity [25].

***Salsola imbricata Forssk*:-** The ethanolic extract of *Salsola imbricata Forssk* was given to male albino rats at the dose of 250 and 500 mg/kg b.w for 65 days, resulted a significant reduction sperm count number. Phytochemical screening showed presence of carbohydrates/glycosides, flavonoid, tannins, sterols/triterpenes, saponin while HPLC profiling of plant showed phenolics such as coumaric acid, quercitrin, rosmarinic acid and catechin. Histology showed architectural abnormalities in sperms of treated animals and sperm motility was also decreased in the high dose group. From the obtained result, it may conclude that the antifertlity activity of *Salsola imbricata Forssk* attributed to its phenolic components, especially quercitrin [26].

***Tabernaemontana divaricata*:-** The ethanolic extract of *T. divaricata* leaves was given to female albino mice at the dose of 250 and 450 mg/kg b.w for 21 days, resulted significant reduction in LH and FSH levels in serum. The extract of plant caused a prolonged eastrous cycle with significant increase in the duration of diestrus phase and elongation of estrus stage in the high dose treated mice. Thus, the study indicates that ethanolic extract of *T. divaricata* has a potential antifertility agent [27].

***Terminalia chebula*:-** The aqueous-ethanolic (1:1) extract of fruits of *Terminalia chebula* was given to male Wistar eats at the dose of 60 mg/0.5 mL distilled water/100 g b.w for 28 days. Result showed a significant reduction in the level of testosterone while the level of cholesterol was increase. Antioxidative enzyme such as catalase, superoxide dismutase was decrease and the level of thiobarbituric acid was increase. The study reveals that *Terminalia chebula* possesses antifertility activity [28].

***Thevetia peruviana*:-** The methanol extract of stem bark of *T. Peruviana* was given to male albino rats at the dose of 100 mg/kg b.w, resulted a significant reduction in the weight of reproductive organs and the biochemical parameter also showed significant decrease total protein, sialic acid and glycogen. Phytochemical screening showed the presence of constituents such as α-amyrin acetate, lupeaol acetate, α-amyrin, β-amyrin, lupeol and thevetigenin. These results suggested that the extract of *T. Peruviana* has an inhibitory effect on spermatogenesis and shows antifertility activity [29].

***Trianthema potulacastrum*:-** The chloroform, alcohol and aqueous extracts of the stem, leaves and roots of *T. Potulacastrum* was given to male albino rats at a dose of 100mg / kg, 200mg/kg and 400mg/kg b. w. Phytochemical screening of the stem, leaves and roots of plant showed presence of phytoconstituents such as alkaloid, flavanoids, phenolics, steroids, tannins and saponin. Result showed significantly increase in uterine weight, diameter of the uterus and thickness of endometrium. From the obtained data, this study indicates that plant has an abortifacient activity [30].

Table 1. Summary of some medicinal plants exhibiting antifertility activity

S. No.	Plant name	Family	Part used	Solvent Used	Active components	References
1.	***Acacia nilotica***	Fabaceae	Pod	Aqueous	Amines, Alkaloid, Terpenoid, Saponin, Flavonoid, Gallic acid, Ellagic acids and Tannins.	[6]
2.	***Aegle marmelos***	Rutacae	Bark	Methanolic	Skimianinc, Sterol, Aegelin, Marmolosin, Altoimperatorin, B-sitosterol, Psoralin, Xanthotoxin, Scopoletin and Tembamide.	[7]
3.	***Alchornea cordifolia***	Euphorbiaceae	Root	Aqueous	Quercetin, Rutin, Flavonoid, Flavones, Tannins, Xanthones and Alkaloid.	[8]
4.	***Andrographis paniculata***	Acanthaceae	Leaf	Aqueous	Andrographolide, Diterpenes, Lactones and Flavonoid.	[9]
5.	***Calendula officinalis***	Asteraceae	Whole plant	Ethanolic	Terpenoid, Flavonoid, Coumarins, Quinones, Volatile oil and Carotenoids.	[10]

6.	***Caesalpinia pulcherrima***	Fabaceae	Leaf	Ethanolic	Flavonoid, Tannins and Glycosidase.	[11]
7.	***Cordia dichotoma***	Boraginaceae	Leaf	Hydroalcoholic	Glycosides, Alkaloid, Flavonoid, Tannins, Volatile and Fixed oils.	[12]
8.	***Cyamposis psoralioides***	Fabaceae	Pod	Ethanolic	Alkaloid, Tannins, Terpenoid and Flavonoid.	[13]
9.	***Dioscorea villosa***	Dioscoreaceae	Tuber	Ethanolic	Alkaloid, Saponin and Flavonoid.	[14]
10.	***Elytraria acaulis***	Acanthaceae	Whole plant	Methanolic	Steroids, Triterpenoid, Flavanoids, Saponin and Tannins.	[15]
11.	***Eugenia singampattiana***	Myrtaceae	Leaf	Ethanolic	Alkaloid, Anthraquinone, Coumarin, Catechin, Glycoside, Flavonoid, Quinone, Saponin, Tannin and Terpenoid.	[16]
12.	***Feronia limonia***	Rutaceae	Fruit	Ethanolic	Alkaloids, Phenolic compounds, Triterpenoids, Coumarins, Tannins and Steroids.	[17]
13.	***Hibiscus rosa sinensis***	Malvaceae	Flower	Benzene	Quercetin, ß-sitosterol, Carotene, Gentisic acid, Alkaloid and flavonoid.	[18]
14.	***Hymenocardia acida***	Phyllanthaceae	-	Ethanolic	Betulinic acid, Lupeol, β-sitosterol, Stigmasterol, Oleic acid, Glycosides, Flavonoid, Saponin and Tannins.	[19]
15.	***Jatropha gossypifolia***	Euphorbiaceae	Leaf	Petroleum ether, Ethanolic, Aqueous	Carbohydrates, Steroids, Glycosides, Flavonoid, Tannins, and Alkaloid.	[20]
16.	***Leptadenia hastate***	Asclepiadaceae	Leaf	Aqueous	Phenolic, Glycosides, Tannins, Flavonoid, Alkaloid, Saponin and Proanthocyanidins.	[21]
17.	***Madhuca latifolia***	Sapotaceae	Seed	Aqueous	Saponin, Glycosides, Alkaloid, Sapogenin, Triterpenoid, madhucic acid and Madhushazone.	[22]
18.	***Michelia champaca***	Magnoliaceae	Leaf	Hydroalcoholic	Steroids, Flavonoid and Alkaloid.	[23]
19.	***Polygala rosmarinifolia***	Polygalaceae	Whole plant	Ethanolic	Alkaloid,Fflavonoid, Tannins, Xanthones, Triterpenes and Quinones.	[24]
20.	***Psidium guajava***	Myrtaceae	Leaf	Aqueous	β-sitosterol, Uvaol, Oleanolic acid, ursolic acid, Tannins, Saponin, Flavonoid and steroids.	[25]

21.	***Salsola imbricata Forssk***	Chenopodiaceae		Ethanolic	Carbohydrates/Glycosides, Flavonoid, Tannins, Sterols/Triterpenes and Saponin, Quercitrin.	[26]
22.	***Tabernaemontana divaricata***	Apocynaceae	Leaf	Ethanolic	Alkaloid, Tannins, Steroid, Triterpenoid and Saponin.	[27]
23.	***Terminalia chebula***	Combretaceae	Fruit	Aqueous, Ethanolic	Tannins, Flavonoid, Sterols, Chebulic acid, Chebulinic acid, Chebulagic acid, Gallic acid, Corilagin and Ellagic acid.	[28]
24.	***Thevetia peruviana***	Apocynaceae	Stem bark	Methanolic	α-amyrin acetate, Lupeaol acetate, α-amyrin, β-amyrin, Lupeol and Thevetigenin.	[29]
25.	***Trianthema potulacastrum***	Aizoaceae	Stem, Leaf, Root	Chloroform, Alcohol, Aqueous	Tannins, Aalkaloid and Phenolic acids.	[30]

CONCLUSION

Herbal remedies used for treat of several diseases in all over world and also have been reported in Ayurveda and folklore. Herbal remedies from plants are considered to be less toxic and free from side effects as compared to available synthetic contraceptive drugs. The information that has been collected from different sources is helpful in discovery of potential agent having capable anti-fertility activity. In conclusion the experimental summary of these medicinal plant in this review may giving suitable information to researchers for further studies and provide a sufficient data toward the direction of clinical trials.

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