

A REVIEW ON MEDICINAL PLANTS EXHIBITING ANTIFERTILITY ACTIVITY

ABSTRACT

This review reveals that some plants and their part used having anti-fertility action, which are helpful for researcher to develop new herbal anti-fertility formulations. In the recent years, interest in drugs of plant origin has been progressively increased. The aim of this review is to highlight the work on anti-fertility of plant origin. We undertook an extensive bibliographic review by analysing peer reviewed papers, and further consulting well accepted worldwide scientific databases. Peer reviewed articles were gathered consulting the databases NISCAIR, SCOPUS, PUBMED and Google scholar using terms such as “antifertility”, “anti-implantation”, and “antispermatogenic” activity of plants. Plants, including their parts and extracts, that have traditionally been used to facilitate antifertility have been considered as antifertility agents. In this paper, various medicinal plants have been reviewed for thorough studies such as *Aegle marmelos*, *Chenopodium ambrosioides*, *Jatropha gossypifolia*, *Leonotis ocyimifolia*. For women who can't use modern forms of contraception due to adverse effect or other reasons, therefore herbs can offer alternatives and reducing fertility would be better than other contraceptives. This review creates a solid foundation upon which to further study the efficacy of plants that are both currently used by women as traditional antifertility medicines, but also could be efficacious as an antifertility agent with additional research and study.

Key words: Anti-fertility, Population Explosion, Birth Control, Literature review, Efficacy, Medicinal plants.

INTRODUCTION

Traditional plants are one of the important parts of human society which helps to fight against number of diseases since the dawn of human civilization. Natural products including plants, animals, and minerals have been the basis of the treatment of diseases from time immemorial. As per WHO, nearly 80% of the developing countries are confronting challenges to afford synthetic drugs and are relying on traditional medicines mainly of plant origin in order to maintain their primary health care needs. ^[1,2]

One of the life-threatening problems of the developing countries is the geometrical rise of human population. This flares up may have a negative influence on our economic policies and would simultaneously misbalance our financial foundation. So, a monitoring is required in the growth of human population ^[3]. The high price of new drug, inaccessibility in the remote area and numerous side effects of the synthetic agents available today for fertility control like hormonal imbalance, increased risk of cancer, hypertension and weight gain have increased the need of herbal medicine which are obtained from the extract of medicinal plant. The study reveals that worldwide, the usage of contraceptive is higher in women. As womenfolk from rural areas as well as developing countries found trouble in accessing

modern contraceptives. So, herbal contraceptives provide an opportunity for them to use cheap, potential and efficient drugs having lesser side effects, particularly to the women living in the rural areas in developing nations with very high population like India, China, Africa and Bangladesh. However, Herbal medicines requires a testing for its efficacy and effectiveness since they do carry minor risks ^[4]. The aim of this review is to collate all available data on plants with antifertility effects. In this review, bibliographic investigation was carried out analysing peer reviewed papers, consulting worldwide accepted scientific databases. Peer reviewed articles were gathered consulting the databases NISCAIR, SCOPUS, PUBMED and Google scholar. Only relevant studies published in English were considered. The list of potential antifertility plants is presented with their scientific name, family and the part of the plant used.

RISKS AND SIDE EFFECTS OF AVAILABLE CONTRACEPTIVES

There are risks associated with certain forms of contraceptives. Oral contraceptive pills are linked with the risk of cardiovascular disease. Tubal infertility, pelvic inflammatory disease, septic abortion, spontaneous abortion, and uterine perforation are associated with Intrauterine device. Surgical risks like anaesthesia, bleeding is associated with tubal sterilization ^[5]. The various side effect associated with emergency contraceptives are abdominal pain, headache, changes in menstrual cycle ^[6]. The various side effects associated with hormonal contraceptives are weight gain, acne, headache, changes in menstrual cycle and changes in mood due to the presence of hormones ^[7]. The use of synthetic estrogen and progesterone is associated with severe side effects like breast cancer, cervical cancer produced by synthetic steroidal contraceptives ^[8].

MEDICINAL PLANTS WITH SIGNIFICANT ANTI FERTILITY ACTIVITY

The concept of fertility regulation is not a new one. Since ancient time, people trust on plant or their extract for fertility control. The Synthetic or chemical-based drugs can interfere with the endocrine system and produce reproductive, neurological, developmental, and metabolic effects in body. These compounds may have negative effects on the synthesis, secretion, transport, and activity of natural hormones. They disturb the normal hormone level either by inhibiting the production and metabolism of hormones or by blocking the hormonal action. Some examples are, Pesticides, Phthalates, Plasticisers inhibit the production of androgen which in turn affects the male sexual development and alkylphenol's, Bisphenol A, Dioxins, heavy metals, fungicides, insecticides stop the synthesis of estrogen and progesterone and thus, affects the female sexual development i.e. toxicity to gonads, testicular germ cell cancer, Breast/ Prostate cancer, endometriosis, these chemicals has shown some other adverse effects on the reproductive system such as infertility on temporary or permanent basis. Due to these reasons, it is necessary to develop purely herbal drug having high efficacy and that will not have any adverse effects on the reproductive system. ^[9] In this review an attempt has been made to document medicinal plants that are usually prescribed as antifertility agents or have been tested for their activity *in vitro* or *in vivo*.

MEDICINAL PLANTS EXHIBITING ANTIFERTILITY ACTIVITY

***Aegle marmelos* (Rutaceae):**

Marked decrement in reproductive organ weight was observed in rats treated with methanolic extract of *Aegle marmelos* bark and shows significant decline in serum testosterone in the treated group. However, methanolic extract of *Aegle marmelos* was found to be dose & duration dependent infertility. The fertility was found to be totally abolished in male rats

treated with 200 and 400 mg/kg body weight for 60 days and 600 mg/kg body weight for 40 days of *Aegle marmelos* bark extracts whereas the antifertility activity of *Aegle marmelos* is reversible in nature. ^[10]

***Ailanthus excella* (Simaroubaceae):**

through this study the researcher has found that the hydroalcoholic extract of *Ailanthus excella* (stem bark) strongly inhibited implantation (72%) and caused abortion (56%) in female rats. It increased the uterine weight significantly ($P < 0.05$) in immature ovariectomised rats. Co-administration of the extract and ethinyl estradiol showed anti-estrogenic activity significantly. However, the antifertility effect of hydroalcoholic extract of *Ailanthus excella* was concluded from above mentioned observations. ^[11]

***Chenopodium ambrosioides* (Amaranthaceae):**

The oral administration of *Chenopodium ambrosioides* leaves extract was found to have significant dose-dependent antifertility activity. The male rat was treated with methanolic extract of *Chenopodium ambrosioides* at different doses of 0, 50, 100 and 150 mg/kg for 28 days which caused remarkable suppression in fertility through decline in sperm count, motility, viability. The antifertility activity of *Chenopodium ambrosioides* is reversible after cessation of treatment. These observations lead to the conclusions that *Chenopodium ambrosioides* produced antifertility activity by virtue of inhibition of sperm synthesis without prominent adverse toxicity. ^[12]

***Curcuma aromatica* (Zingiberaceae):**

The ethanolic and aqueous extract of *Curcuma aromatica* retarded pregnancy at two different dose i.e 200mg kg⁻¹ and 400 mg kg⁻¹ b.w. However, the aqueous extract was found to be more potent ($p < 0.001$) antifertility activity compared to alcoholic extract. ^[13]

***Dactyloctenium aegyptium* (Poaceae):**

The whole plant of *Dactyloctenium aegyptium* extracted with ethanol. The extract was administrated at a dose of 200, 400, and 600 mg/kg body weight, respectively for a period of 30 days. Which cause a non-significant increase in the body weight and a significant decrease in weight of testes, accessory sex organs, along with the reduction in sperm count, increase motility and abnormality of sperm. Decreased sperm count, weight of reproductive organs, serum hormonal levels and number of implantations in female rats ceased the fertility with dose dependent manner. ^[14]

***Derris brevipes* (Papilionaceae):**

Oral administration of alcoholic extract (ethanol) of *Derris brevipes* root produced retardation of implantation by 40% at dose level 600 mg/kg. After full gestation period the pregnant rats (treated with *Derris brevipes* root ethanolic extract) were unable to deliver any offspring i.e the extract is having 100% antiimplantation and abortifacient activity. ^[15]

***Heliotropium indicum* (Boraginaceae):**

Oral administration of *Heliotropium indicum* ethanolic extract and its fractions at two different doses (200 and 400 mg/kg body weight) have significant antifertility activity. However, 30% and 35% Pre-implantation loss was observed in anti-implantation model with ethanolic extract whereas n-hexane fraction shown 40% and 60% and benzene fractions have shown 30% and 50% pre-implantation loss. 50% and 60% abortion were observed in

abortifacient activity model with ethanolic extract whereas n-hexane fraction shown 50% and 60% and benzene fractions have shown 30% and 60% abortion.^[16]

***Hymenocardia acida* (Phyllanthaceae):**

The aqueous ethanolic extract of *Hymenocardia acida* (stem bark) shows inhibitory effects on reproductive functions in female albino rats. Oral administration of the extract from days 1 to 19 of gestation showed reduction ($p < 0.05$) in the number of corpora lutea of pregnancy and number of live fetus.^[17]

***Jatropha gossypifolia* (Euphorbiaceae):**

Ethanolic and aqueous extract of *Jatropha gossypifolia* leaves reported to have significant antifertility activity by means of potent estrogenic, anti-implantation, and early abortifacient activities in a dose-dependent manner. Through the study it was proposed that the terpenoids, phytosterols, and flavonoids present in the extracts may be responsible for their activity. However, the ethanolic extract of *Jatropha gossypifolia* revealed more significant estrogenic activity with the increase in uterine weight, as compared to control group of rats.^[18]

***Leonotis nepetifolia* (Lamiaceae):**

Through the study it was found that the ethanolic extract of *Leonotis nepetifolia* (whole plant) have a significant antifertility activity in male Wistar albino rats. The route of administration was oral.^[19]

***Leonotis ocymifolia* (Lamiaceae):**

The anti-fertility effect of the aqueous and ethanol extracts of the leaves and roots of *Leonotis ocymifolia* were studied both in vivo and in vitro. The anti-implantation and anti-fertility activities of the ethanol leaves extract were found to be 37% and 20%, respectively. Administration of aqueous root and leaf extracts reduced the number of implants. However, no significant difference was observed between the average number of implants counted in rats treated with ethanol leaf extract and the control group. All extracts were observed to increase acetylcholine induced uterine contraction. The results of this study suggest that the leaves and roots of this plant may possess hormonal properties that can modulate the reproductive function of the rats.^[20]

***Michelia champaca* (Magnoliaceae):**

Michelia champaca L. is commonly known as Champa in Hindi and is traditionally used for fertility regulation by the women of Chhattisgarh state in India. The antifertility activity of the extract administered at dose levels of 100 and 200 mg/kg body weight, po. The study was evaluated in two experimental animal models i.e. anti-implantation activity in female wistar rats and estrogenic/antiestrogenic activity in ovariectomized female rats. The extract showed significant ($p < 0.01$) 49.95% and 71.03% anti-implantation activities at 100 and 200 mg/kg doses respectively. The extract also exhibited significant ($p < 0.01$) estrogenic activity as evidenced by increase in body weight, uterine weight, increased thickness and height of endometrium, vaginal cornification and significant ($p < 0.01$) increase in estrogen, cholesterol, alkaline phosphate and triglycerides levels at higher dose when administered alone as well as along with ethinyl estradiol.^[21]

***Nelumbo nucifera* (Nelumbonaceae):**

Nelumbo nucifera seed extract exhibited a significant decrease in the ovarian weight, glycogen and protein level. In contrast, the extract caused significant increase in cholesterol level. *Nelumbo nucifera* extract also caused elongation in diestrous phase of the estrous cycle. Through their observation they have concluded that *Nelumbo nucifera* possessed the anti-estrogenic properties, but the extract did not affect the female rats physiologically.^[22]

***Piper betel* (Piperaceae):**

Ethanol extract of *Piper betel* caused irregular extended estrous cycle along with decrease in the weight of reproductive organ, estrogen level and number of litters delivered. Decline in enzymatic activity of acid phosphatase, concentration of serum glucose, SGOT and SGPT level were observed in extract treated group as compared to the control group. All these observations suggested the antifertility and antiestrogenic activity of *Piper betel* ethanolic extract in female rats without causing any toxic effects.^[23]

CONCLUSION

Medicinal plants are one of the important parts of human civilization which helps to fight against number of diseases since the beginning of human culture. Numerous approaches have been used for the suppression in fertility whereas herbal contraceptive offer alternative for both men as well as women who have trouble in accessing modern contraceptives mainly in rural areas and in developing countries like India. From the study, it was clear that the above-mentioned plant has significant antifertility activity. The review showed that numerous plants that are used traditionally for suppression in fertility have good potentials for use in control of birth. Hence, it is concluded that this review may focus the researcher's attention for clinical studies which could be of great scientific contribution to the society.

NOTE:

The study highlights the efficacy of "herbal medicine" which is an ancient tradition, used in some parts of India. This ancient concept should be carefully evaluated in the light of modern medical science and can be utilized partially if found suitable.

REFERENCE

1. Goswami, P., Islam, R., Khongmalai, E., Sarkar, B. R., Sen, S., & Dey, B. K. (2017). Pharmacognostical and preliminary phytochemical screening of leaves of *Polygonum muricatum*. *Int J Res Pharm Pharm Sci*, 2(3), 6-10.
2. Choudhury, A., Marbaniang, B., Sutnga, I., Hazarika, G., Goswami, P., & Dey, B. K. (2020). Pharmacognostic and preliminary phytochemical screening of *Trachyspermum khasianum* H. Wolff. *Indian Journal of Natural Products and Resources (IJNPR) [Formerly Natural Product Radiance (NPR)]*, 11(2), 101-109.
3. Goswami, P., Laskar, M. A., & Basak, M. (2020). A Review on Medicinal Plants of North Eastern Region with Potential Antifertility Activity. *Asian Journal of Pharmaceutical Research and Development*, 8(3), 162-165.
4. Bala, K., Arya, M., & Katare, D. P. (2014). Herbal contraceptive: an overview. *World J Pharm Pharm Sci*, 3(8), 1305-1326.
5. National Research Council (US) Committee on Population. Contraception and Reproduction: Health Consequences for Women and Children in the Developing

- World. Washington (DC): National Academies Press (US); 1989. 4, Contraceptive Benefits and Risks.
6. World Health Organization Department of Reproductive Health and Research (WHO/RHR) and Johns Hopkins Bloomberg School of Public Health/Center for Communication Programs (CCP), Knowledge for Health Project. Family Planning: A Global Handbook for Providers (2018 update). Baltimore and Geneva: CCP and WHO; 2018. Available from: <http://www.who.int/reproductivehealth/publications/fp-global-handbook/en/>
 7. Sabatini, R., Cagiano, R., & Rabe, T. (2011). Adverse effects of hormonal contraception. *Journal für Reproduktionsmedizin und Endokrinologie-Journal of Reproductive Medicine and Endocrinology*, 8(1), 130-156.
 8. Shukla, A., Jamwal, R., & Bala, K. (2017). Adverse effect of combined oral contraceptive pills. *Asian J Pharma & Clin Res*, 10, 17-21.
 9. Azamthulla, M., Balasubramanian, R., & Kavimani, S. (2015). A review on medicinal plants exhibiting antifertility activity. *World J Pharm Pharm Sci*, 4(3), 243-272.
 10. Agrawal, S. S., Kumar, A., Gullaiya, S., Dubey, V., Nagar, A., Tiwari, P., Dhar, P., & Singh, V. (2012). Antifertility activity of methanolic bark extract of *Aegle marmelos* (L.) in male wistar rats. *DARU Journal of Pharmaceutical Sciences*, 20(1), 1-10.
 11. Ain, Q. U., David, M., Shah, Q., Ahmad, M., & Jahan, S. (2018). Antifertility effect of methanolic leaf extract of *Chenopodium ambrosioides* Hook. in male Sprague Dawley rats. *Andrologia*, 50(10), e13129.
 12. Ravichandran, V., Suresh, B., Sathishkumar, M.N., Elango, K. and Srinivasan, R., (2007). Antifertility activity of hydroalcoholic extract of *Ailanthus excelsa* (Roxb): an ethnomedicines used by tribals of Nilgiris region in Tamilnadu. *Journal of Ethnopharmacology*, 112(1), 189-191.
 13. Trishna, D., Bhushan, M. S., Mrinmoy, B. A. S. A. K., Mohanty, J. P., & Dibyendu, S. (2010). Evaluation of phytochemical screening and anti-fertility activity of *Curcuma aromatica* Salisb. *Int J Pharm Sci Res*, 1(1), 18-22.
 14. Naik, B. S., Dangi, N. B., Sapkota, H. P., Wagle, N., Nagarjuna, S., & Sankaranand, R. (2016). Phytochemical screening and evaluation of anti-fertility activity of *Dactyloctenium aegyptium* in male albino rats. *Asian Pacific Journal of Reproduction*, 5(1), 51-57.
 15. Savadi, R. V., Alagawadi, K. R., & Darade, S. S. (2009). Antifertility activity of ethanolic extract and its n-hexane and benzene fractions of *Heliotropium indicum* leaves on albino rats. *Journal of Pharmacy research*, 2(5), 927-930.
 16. Badami, S., Aneesh, R., Sankar, S., Sathishkumar, M.N., Suresh, B. and Rajan, S., (2003). Antifertility activity of *Derris brevipes* variety coriacea. *Journal of ethnopharmacology*, 84(1), 99-104.
 17. Hyacinth, A. A., & Nwocha, U. C. (2011). Antifertility activity of aqueous ethanolic extract of *Hymenocardia acida* stem bark in female rats. *Iranian Journal of Reproductive Medicine*, 9(3), 217.
 18. Jain, S., Choudhary, G. P., & Jain, D. K. (2013). Pharmacological evaluation and antifertility activity of *Jatropha gossypifolia* in rats. *BioMed research international*, 2013.
 19. Kadalmani, B., Niranjana, R., Natarajan, U. A., & Chandiran, I. S., (2020). Antifertility and Antioxidant Activities of Ethanolic Extract of *Leonotis nepetifolia* in Male Albino Rats. *SBV Journal of Basic, Clinical and Applied Health Science*, 3(3), 115-121.

20. Tafesse, G., Mekonnen, Y., & Makonnen, E. (2005). In vivo and in vitro anti-fertility and anti-implantation properties of *Leonotis ocymifolia* in rats. *African Journal of Traditional, Complementary and Alternative Medicines*, 2(2), 103-112.
21. Taprial, S., Kashyap, D., Mehta, V., Kumar, S. & Kumar, D., (2013). Antifertility effect of hydroalcoholic leaves extract of *Michelia champaca* L.: An ethnomedicine used by Bhatra women in Chhattisgarh state of India. *Journal of ethnopharmacology*, 147(3), 671-675.
22. Mutreja, A., Agarwal, M., & Kushwaha, S., & Chauhan, A. (2008). Effect of *nelumbo nucifera* seeds on the reproductive organs of female rats. *International journal of reproductive biomedicine* (iranian journal of reproductive medicine), 6(1), 7-11. <https://www.sid.ir/en/journal/ViewPaper.aspx?id=107908>
23. Sharma, J.D., Sharma, L. & Yadav, P., (2007). Antifertility efficacy of *Piper betle* Linn. (Petiole) on female albino rats. *Asian J Exp Sci*, 21(1), 145-150.

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