REVIEW OF LITERATURE

Many plants are mentioned in our ancient literature as well as traditional literature and are used by tribals and by rural communities to prevent pregnancies. Although use of many herbal medicines is well documented in our ancient literature but these are not supported by experimental evidences. Initially scientific work on medicinal plants was done during 1960s, 70s and 80s. Then enthusiasm of the scientific community declined. But after success of some plant products now global interest in plant products has increased. In last one or two decades interest of scientific community has developed in medicinal plants and there is much advancement in research in this field.

The work done on Indian Medicinal Plants was compiled in the form of a book by Kartikar and Basu in 1918 and in 1933, for the first time. Delazlo and Hansaw (1954) initiated the interest of the use of plants to induce infertility in male. In 1976 and 1987 Indian Council of Medical Research, New Delhi published two volumes on Medicinal Plants of India.

In 1960 spermicidal activity of Canscora decusata on human volunteers was studied by B.R. Madan. Antispermaticgenic property of leaf extract of Vinca rosea was studied by Joshi and Ambaye in 1968 and Chinoy et. al., in 1983.

In 1971, Arora et. al. studied antifertility activity of Embelia reibes. Kholkute et. al. (1978) and Purandare et. al. (1979) studied contraceptive activity of an indigenous plant E. reibes, berries. Antifertility effect of E. reibes, in male rats was also studied by Agarwal
et. al. in 1986. Gupta et. al. (1989) also studied anti-spermetogenic effect of *E. reibes*, a plant benzoquinone on male albino rats *in vivo* and *in vitro*.

In 1972, Kashinathan et. al reported antifertility activity of *Ocimum sanctum*. Anti-spermatogenic effect of *Ocimum sanctum* was also studied by Setb et. al. in 1981. Khanna et. al. (1986) studied effect of long term feeding of tulsi *O. sanctum* L on reproductive performance of adult albino rats. Ahmed et. al. in 2002 reported reversible antifertility effect of benzene extract of *O. sanctum* leaves on sperm parameters and fructose content in rats. Effect of crude aqueous extract of *O. gratissimum* leaves on testicular histology and spermiogram in the male albino rats (*Wistar* strain) was studied by Olufisayo et. al. in 2008.

Spermicidal activity of *Trigonella foneum-graecum* seeds was first studied by Setty et. al. (1976). Tyagi et. al. (1989) studied effect of acetone extract of *T. foneum-graecum* L. on male reproductive organs of albino rats. Antifertility effect of acetone extract of *T. foneum-graecum* L on testes and epididymis of male albino rats was studied by Tyagi et. al. (1989). Tyagi et. al. (1989) also reported spermicidal activity of aqueous extract of *T. foneum-graecum* L. in albino rats. Tyagi et. al. (1994) also reported antifertility effect of acetone extract of *T. foneum-graecum* L. on testes and epididymis of male albino rats. Bansal et. al. (1997) studied the antifertility effects of *T. foneum-graecum* aqueous extract on male albino rats.

Setty and Kamboj et. al. (1976) studied the spermicidal potential of saponins from Indian plants. Setty et. al. (1977) studied the spermicidal activity of some Indian plants such as *Albizzia lebbeck,*
Caltha pallustris, Clerodendrum serratum and Nothopegia colebrookiana.

Pakrashi et. al. (1958) reported effect of Malva viscus conzatti flowers extract on male fertility. In 1977 Dixit et. al. showed the effect of M. viscus conzatti flower extract on testicular function of the house rat Rattus rattus and male gerbil Meriones hurrianae. Dixit (1977) and Joshi et. al. (1981) studied antifertility activity of M. viscus conzatti in different animal models. Antifertility effect of M. viscus conzatti flower extract on the male albino mice was studied by Verma et. al. (1980). Joshi et. al. (1981) studied antifertility effect of chronically administered M. viscus conzatti flower extract on male albino rats. Chakrabortary et. al. (1991) studied antifertility effect of chronically administered M. viscus conzatti flower extract on male rats. In Singh et. al. reported study of antifertility effect of alcoholic extract of M. viscus conzatti Greenm in male albino rats.

Dixit et. al. (1978) worked on effect of Momordica charantia L fruit extract on testicular function in dogs. Antifertility activity of Lygodium flexuosum was studied by Gaintonde and Mahajan in 1980. Effect of Pueraria tuberose DC on reproductive performance of rats was studied by Chandhoke et. al. (1980). Antifertility effect of common edible Portulaca oleracea on the reproductive organs of male albino mice was studied by Verma et. al. in 1982.

A major milestone in the development of male antifertility agents was the discovery of gossypol as a potential male fertility regulating agent by Chinese scientists. In 1980, Dai and Pan and in 1981, Zhou and Lei reported that long term treatment of gossypol may cause complete atrophy of the seminiferous epithelium in some of the rats, indicating the possibility of irreversibility of fertility.

Xue (1981), Lei (1983) conducted extensive studies on antifertility activity of gossypol. In 1989, Agarwal studied the antifertility effects of optical isomers of gossypol. Effect of gossypol on few testicular enzymes in mature was rats studied by Bhiwade et. al. in 1989. In 1990, Kalla studied response of mice testes to gossypol acetic acid and also the effect of gossypol on the fertility of male rats. In 1990, Singh S.K. and Rath S.K. reported histological changes in the mouse testes after treatment with gossypol tetra acetic acid. Gossypol caused some adverse side effects such as hypokalaemia and irreversibility of fertility in a few percentage of the volunteers during clinical trials conducted by Liu et. al. (1981), Prasad and Diczfalasy (1982), (1983) and Lee (1983).

Atrophy of testicular and epididymal elements by feeding alcoholic extracts of Portulaca oleracea and Protulaca quadrifida was reported by Verma et. al. in 1981, and 1982. In 1982, antifertility activity of Allium sativum was studied by Dixit and Joshi. Rao (1988), reported arrest of spermatogenesis by use of alcoholic extract of Solanum xanthocarpum. Sinha et. al. (1986) reported antifertility activity of alcoholic extract of Syzygium cumini seeds.

Purohit et. al. (1990), studied the antifertility efficiency of the plant Striga lutea in rats. Tyagi et. al. (1991), studied antifertility activity of Canscora decusata in male albino rats. The antispermaticogenic effect

Chinoy et. al. (1984) studied induction of functional sterility in male albino rats treated with aqueous extract of *Carica papaya* seeds. Antifertility investigation on the crude chloroform extract of *C.papaya* Linn seeds in male albino rats was conducted by Lohiya et. al. (1992). Antifertility effect of aqueous extract of *C.papaya* seeds in male rats was studied by Lohiya et. al. in 1994. In 1997, Chinoy et. al. observed reversible effect of aqueous extract of *C.papaya* seeds on microenvironment and sperm metabolism of cauda epididymis of rats. Lohiya et. al. (1999) studied the reversible contraception with chloroform extract of *Carica papaya* Linn seeds in male rabbits. Lohiya et. al. (2002) also reported that chloroform extract of seeds of *C.papaya* induces long term reversible azoospermia in langur monkey. Manivannan et. al. (2004) studied ultrastructural changes in the testes and epididymis of rats following treatment with the benzene chromatographic fraction of the chloroform extract of the seed of *Carica papaya*. Udoh et. al. (2005) studied hepatotoxicity of the methenol extract of *C.papaya* seeds in Wistar rats. Studies on antifertility effects of paw paw seeds (*Carica papaya*) on the gonads of male albino rats was studied by Udoh et. al. (2005) Manivannan et. al. (2009) reported
sperm characteristics and ultrastructure of testes of rats after long-term treatment with the methanol sub-fraction of *C. papaya* seeds.

Antifertility effect of *Piper betle* L extract on ovary and testes of albino rats was reported by Adhikari et al. (1989). Sarkar et al. (2000) observed the reversible antifertility effect of *Piper betle* Linn. on Swiss albino male mice. Antifertility efficacy of *Piper betle* Linn. (Petiole) on female albino rats studied by Sharma et al. (2007). Mishra et al. (2009) reported antispermatic and antifertility effects of fruits of *Piper nigrum* L. in mice.

In 1990, Dwivedi et al. observed spermicidal potential of *Sapindus saponin*. Reproductive, haematologic and biochemical profile of male rats treated with aqueous extract of *Spondias mombin* bark was studied by Raji in 2006.

_Azadirachta indica_ is another plant, besides gossypol that has been extensively studied for its antifertility potential. Joshi et al. (1990), observed contraceptive efficiency of *A. indica* (flower and bark) in male rats. In 1993, Upadhyay et al. studied antifertility effects of neem (*A. indica*) oil in male rats by single intravas administration. Kasturi et al. (1995) reported changes in epididymal structure and function of albino rats treated with *A. indica* leaves. In 1996, S.S. Rair worked on antifertility activity and other medicinal properties of neem. Joshi et al. (1996), Prasad et al. (1997) also observed antifertility activities of different extracts of *A. indica*. In 1999, Ravindranath studied effect of *A. indica* leaves on rat spermatozoa. Aladakatti et al. (1999) reported changes in spermatozoa of rats after treatment with *A. indica* leaves. Again in 2001, Aladakati et al. reported changes in sperm parameters induced by *A. indica* in albino rats. Spermicidal activity of *A. indica*
(neem) leaf extract was studied by Khillare et. al. in 2003. Ultrastructural changes in cauda epididymal epithelial cell types were reported by Ghodesawar et. al. in 2004 A.indica treated in rats leaf. In 2005, Mishra et. al. worked on effect of aqueous extract of A.indica on the reproductive organs in male mice. In 2005, Dehghan et. al. studied antifertility effect of Iranian neem seed alcoholic extract on epididymal sperm of mice. Deshagan et. al. (2006) studied histology of male reproductive organs after treatment with Iranian botanical A.indica (neem) seed extract. Spermicidal activity of A.indica (neem) aqueous leaf extract on male albino rats was studied by Sathiya Raj et. al. in 2010.

Kesman (1990), worked on reversibility effect of LHRH agonists and other antiandrogenic hormones on the testes. Dafau et. al. (1993) used corticotropin releasing factor as an antireproductive hormone of the testes. Bebb et. al. (1996) observed that combined administration of levonorgestrel and testosterone induces more rapid and effective suppression of spermatogenesis than testosterone alone. Anawalt et. al. (1999) reported that lower dosage of levonorgestrel and testosterone combination effectively suppresses spermatogenesis and circulating gonadotropin levels. Meriggiola et. al. (1997) used progestin androgen combination regimen for male contraception. In 1999 Wu et. al. reported that oral progestogen combined with testosterone worked as a potential male contraceptive. Raji et. al. in 1997 worked on antifertility activity of Quassia amara in male albino rats. Antispermatogenic and antiandrogenic activities of Momordica charantia (karela) in albino rats were studied by Naseem et. al. (1998). Piyachaturawat et. al. (1999) worked on effect of Curuma comosa extract on male fertility in albino rats. In 1999 Wu et. al. reported that oral progestogen combined with testosterone worked as a potential male contraceptive.
Zhang et. al. (1999) conducted a clinical trial of injectable testosterone enecanoate as potential male contraception in normal chinese men.

In 2000, Akbarasha et. al. reported male antifertility property of andrographolide isolated from Andrographis paniculata in albino rats and studied its effect on the testes and cauda epididymal spermatozoa. Kamboj et. al. (2000) published a review article about herbal medicines. In 2000, Anawalt et. al. showed that desogestrel plus and testosterone effectively suppresses spermatogenesis but also cause modest weight gain and high density lipoprotein suppression.

Decrease in sperm number after treatment of rat with Austroploncpia populena was observed by Mazaro et. al. in 2000. Effect of Terminalia cutappa seeds on sexual behavior and fertility of male rats was studied by Ratnassoriya et. al. (2000). Watche et. al. (2001) studied antispermaticogenic and antifertility activity of Mondia whitei in male albino rats and reported these effects to be reversible. Md. Golam Sadik et. al. (2001) studied antifertility activity of the alkaloidal fraction of Pergularia daemia on male albino mice.

Antifertility studies of the root extract of Barleria prionitis Linn in male albino rats with special reference to testicular cell population dynamics was studied by Gupta et. al. in 2002.

Effect of Lepiduim meyenti (maca) roots on spermatogenesis of male rats was studied by Chatterjee et. al. (2001).

Gupta et. al. (2001) conducted studies on antifertility activity of Colebrookia oppositifolia leaves on male albino rats. In 2001, Sharma and Jacob investigated antifertility and toxicological properties of the
petroleum ether extract of leaves of *Mentha arvensis* in male albino mice. Sharma et. al. (2002) conducted assessment of reversible contraceptive efficacy of methanol extract of *Mentha arvensis*. Antifertility study of *Colebrooking oppositifalia* leaf extract on testicular cell population dynamics was studied by Gupta et. al. (2001). Lohiya et. al. (2001) published a review article on prospects of developing a plant based male contraceptive pill in fertility regulation.


Silveria et. al. (2003) evaluated long-term exposure of *Mikania glomerata* (Sprengel) extract on reproductive organs, sperm production and testosterone level of male Wistar rats. Mishra et. al. (2003), studied response of the reproductive organs to certain plant preparations in the male laboratory mouse. Antifertility effect of ethanolic extract of *Amalakyadi churna* in male albino mice was studied by Seetharam et. al. in 2003. Antifertility activity of Derris *brevipes* was studied by Badami et. al. in 2003. Vijay Kumar et. al. (2003) worked on
antifertility activity of various extracts of *Crotalaria juncea* Linn. seeds in male mice.

In 2004, Gupta et. al. studied antifertility effet of methanolic pod extract of *Albizzia lebbeck* in male rats. Antifertility activity of ethanol extract of *Aristolochia tagala* leaf was studied by Balaji et. al. in 2004. Bhatia et. al. (2004) worked on alteration in the functional status of reproductive organs of male albino rats after the oral administration of decoction and ethanolic extract of *Adiantum incisum*. Antispermatogenic and hormonal effects of seed extract of *Crotalaria juncea* Linn. were studied by Kumar et. al. in 2004.

Chattopadhyay et. al. (2005) studied sperm motility inhibiting activity of *Alstonia macrophylla* leaf extract, a plant that is used by tribals as medicine for stomach ache, skin diseases and gastrointestinal troubles. In 2005 Gebri et. al. studied the possible mechanisms for the antifertility action of methanolic extract of root of *Rumex studelii*.


Bhatt et. al. (2007) reported contraceptive evaluation of seed extract of Abrus precatorius (L) in male mice (Mus masculus). Krishnamoorthy et. al. (2007) reported effect of T. chebula fruit extract on lipid peroxidation and antioxidative system of testis of albino rats. Munshi et. al. (2007) studied effect of aqueous extract of Anethum graveolens (L) on male reproductive system of rats.

Reversible changes in the fertility of male albino rats by Aegle marmelos were studied by Chauhan et. al. (2008). Antifertility activity and phytochemical studies of Pergularia daemia leaves in male albino rats was studied by Londonkar et. al. 2008. Mishra et. al. (2009) evaluated anti fertility potential of aqueous extract of Bougainvillea spectabilis leaves in Swiss albino mice.

Sathiyaraj et. al. (2010) observed antifertility effect of aqueous leaf extract of Aegle marmelos on male albino rats. Kumar et.al. (2011) isolated and evaluated antifertility activity of total alkaloids from leaves of Aegle marmelos in male albino rats.

In 2009, Savadi et. al. studied antifertility activity of ethanolic extracts of Plumbago indica and Aerva lonata on albino rats. Antifertility activity of ethanolic extract of Allium cepa Linn in rats was
studied by Thakre et. al. (2009). In 2009, Singh et. al. evaluated antifertility potential of Brahmi in male mouse.

Bhatia et. al. (2010) reported antifertility effects of crude extract of Adiantum lunulatum Burm on reproductive organs of male albino rats. Effect of Tecoma stans leaves on the reproductive system of male albino rats was studied by Mathur et. al. (2010). A survey of plants having antifertility activity from Western ghat area of Maharashtra state was conducted by Pokharkar et. al. (2010). Rao et. al. in 1989 worked on effects of alcoholic extract of Terminalia bellirica fruit extract on male reproductive functions. Venkatesh et. al. (2002) made a comparative study of effect of alcoholic extracts of Sapindus emarginatus, Terminalia bellirica, Cuminum cyminum and Allium cepa on reproductive organs of male albino rats. Satishgouda et. al. in 2009 observed contraceptive effect of Terminalia bellirica (Bark) extract on male albino rats. In 2006, Singh et. al. reported antifertility effect of alcoholic extract of Terminalia bellirica in male albino rats. A study of biochemical parameters of male albino rats treated with alcoholic extract of Terminalia bellirica was conducted by Singh et. al. in 2010. Effect of Terminalia bellirica bark extracts on activities of accessory reproductive ducts in male rats was observed by Patil et. al. (2010). Study of antifertility effect of aqueous extract of Terminalia bellirica leaves on male albino rats was conducted by Singh et. al. in 2012. In 2010, Sachin et. al. evaluated antifertility activity of Tabernaemontana divaricata (Linn) R. Br. leaves in rats. D Cruz et. al. in 2010 worked on effects of plants and plant products on the testes.

In 2011, Chaudhary et. al. studied reversible contraceptive efficacy and conducted safety evaluation of ethanolic extract of Maytenus emarginata in male albino rats. Kachroo et. al. (2011),
worked on anti-implantation activity of different extracts of the peels of *Citrus medica*.

Antifertility activity of aqueous leaf extract of *Andrographis paniculata* in male albino rats was tested by Sathiya Raj et. al. (2011). Shivabasavaiah et. al. (2011) studied antifertility effects of *Madhuca indica* leaves in male Swiss albino rats. In 2011, Shajeela et. al. reported antifertility activity of ethanol extract of *Dioscorea esculenta* (L) Schott on male albino mice. Antifertility potential of *Abrus precatorius* in male albino mice was studied by R.A. Morey and A.J Khanda et. al., in 2011. Sarwar et. al., in 2011 published a review of the recent advances in pharmacological studies on medicinal plants. In 2011 Bayala et.al., conducted a study on effect of aqueous extract of *Leptadeina hastate* on male reproductive function.

Antifertility activity of *Cryptolepis sanguinolenta* leaf ethanolic extract in male rats was studied by Ayodeji et.al. (2012). Antifertility effect of *Cyamopsis psoraliodes* in male Swiss albino mice was studied by Thejashwini et.al. in 2012.

Priya G et.al. in 2012 evaluated anti-fertility activity of ethanolic extract of *Carria fistula* (Linnaeus) leaf on male albino rats.

Balamurugan et.al. in 2013 reported stimulatory effect of the ethanol extract of *Melastoma malabathricum* L.(Melastomataceae) leaf on the reproductive system of male albino rats. Oia et. al., in 2013 studied antifertility activity of ethanolic seed extract of Celery (*Apium graveolens* L.) in male albino rats. Alagammal et.al., in 2013 reported anti-fertility activity of whole plant extracts of *Polygala rosmarinifolia* Wight & Arn against male albino rats. T. Sundar Rajan et.al. in 2013
evaluated anti-fertility activity of herbal oral contraceptive suspension in male Wistar albino rats.

In 2014, Mohammad Taher et. al. reported cytotoxicity and antifertility effect of *Artemisia Kopetdaghensis*. Fernand Labrie et.al. in 2014 studied the antifertility effects of LHRH in the male. In 2014, V.Y. Deshpande et.al. studied male antifertility activity of *Azadirachta Indica* in mice.