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Study of Antifertility Properties of *Catharanthus Roseus*

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ABSTRACT

C. roseus which belongs to Apocynaceae family. The whole plant part used as herbal medicine. It shows many pharmacological uses in medicinal world including antibacterial, antidiabetic, antioxidant, antihelminthic, antifeedent, antisterility, antidiarrheal and many more. In this review article we will discuss the antifertility property of *C. roseus*. It contains steroids, flavonoids and alkaloids etc. In term of antifertility, this plant effect on sertoli cells, leydig cells, steroidogenesis, antispermatogenic, antifertility, antiestrogenic, effect on sperm count, mortality, morphology.

KEYWORDS: *Catharanthus roseus, Apocynaceae, antifertility, antispermatogenic, antiestrogenic, sperm count, sertoli cells*

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INTRODUCTION

In recent times, the world is facing a big problem and that is over-population. Today India has achieved the first rank in the world for population. If we talk about the data today the population is more than 141 crore. We will get to see more increase in population in the coming times. So, it is very necessary to control as it is very harmful for our society, our Nation and also for our ecosystem.

In the present study, we will discuss the anti-fertility activity of medicinal plant of *C. roseus*. Anti-fertility means reducing fertility. Infertility is the inability of a male or female to procreate as a result of an issue with either partner's reproductive system. Infertility is mainly of two types i.e. Primary infertility and Secondary infertility. When a person is completely unable to procreate, that is primary infertility. Someone who has previously produced but is no longer able to does so with secondary infertility (Brazier, 2022). Oral contraceptives and anti-fertility medicines are both medications that regulate fertility. Birth control tablets contain a combination of oestrogen and progesterone. In males, it suppresses testosterone, inhibits spermatogenesis, affects the organ gonadotrophins or sperm viability (Daniyal & Akram, 2014). Many plant extracts can be used to make contraceptives and can reduce both male and female fertility. Only a small number of medicinal herbs have so far been tested for their ability to suppress fertility, despite the fact that many of them have been claimed to do so. In addition, the World Health Organization (WHO) has established a task group on plant research to identify new non-steroidal contraceptive chemicals that are orally active (Montaserti et al., 2007).

For this review article, we are going to focus on antifertility property of *C. roseus*. Regulation No. 10 of 2014, which was published by the Indonesian National Agency of Drugs and Food Control, forbids the creation (manufacturing & distribution) of herbal medicines / supplements manufactured from *C. roseus*. This raises concerns and claims about whether *C. roseus* is a harmful plant (Indonesia National agency of Drugs and Food control,2014). The alkaloids in *C. roseus* may lead to bone marrow depression, according to the regulation. It's interesting that numerous research point to *C. roseus*

having a wide range of pharmacological effects (Sutrisna, 2015). As a well-known member of the Apocynaceae family of plants, *C. roseus* is a rich source of alkaloids that are found throughout the entire plant (Aslam et al., 2010). It's able to produce more than 100 monoterpenoid indole alkaloids (MIAs), including the two most significant and commercially significant cytotoxic dimeric alkaloids used in cancer chemotherapy, made *C. roseus* one of the most utilised and studied medicinal plants (Magnotta et al., 2006). Vinblastine and vincristine, two of the main alkaloids found in *C. roseus*, were specifically used to create prescription anticancer medications (Duflos et al., 2002).

Traditional use

There are numerous pharmacological effects of *C. roseus*, a strong medicinal herb, including antibacterial, antioxidant, antihelminthic, antifeedant, antisterility, antidiarrheal, and antidiabetic effects (Gajalakshmi et al.,2013). In Northern Europe (Swanston-Flatt) and India, *C. roseus* leaves are frequently used as an anti-diabetic (Tiong et al., 2013). *C. roseus* leaf tea is used as an anti-diabetic in Brazil, Dominica, England, Cook Islands, Jamaica, Mozambique, Pakistan, Taiwan, Thailand, and the West Indies (Don, 1999). People in South Africa use *C. roseus* to treat urogenital infections (Fernandes et al., 2008), diabetic nephropathy (Zulu people) (Dauskardt, 1990), menorrhagia (Hutchings et al.,1996) and rheumatism (Marles & Farnsworth, 1995). This herb was utilised in Southern and Eastern Africa to treat various venereal illnesses (Watt & Breyer, 1962). *C. roseus* was utilised by the locals of Mutirikwi, Zimbabwe, to relieve stomach aches (Chigora et al., 2007). In the Kancheepuram District of Tamil Nadu, India Diabetes mellitus was treated with a decoction of *C. roseus* leaves (Muthu et al., 2006). Moreover, it has been used internally to treat conditions like memory loss, hypertension, cystitis, gastritis, enteritis, diarrhoea, and high blood sugar (Dessisa, 2001).

Materials and Methods

The material presented in this research is the outcome of a thorough bibliographic investigation that involved studying scholarly journals, classic textbooks, and internationally recognised databases. Peer-reviewed articles were acquired from a variety of sources, including PUBMED, Google Scholar, Webmed, Medical news today, Healthline, Review article and others.

This review focused on using *C. roseus*, which has been cited for its use as an antifertility agent in traditional medicine. It also includes plant extracts, which have already been demonstrated by numerous scientific articles.

Study

The name "Periwinkle" or "*Catharanthus roseus*" (Family Apocynaceae), often referred to as "Nayantara" or "Sadabahar," comes from the Greek word which means "pure flower." Whereas roseus is Latin word which means "red," "rose," or "rosy" (Balaji, 2014).

Since the beginning of time, plant-based medications have been utilised for their effects on sex hormones, primarily for the suppression of fertility (Williamson et al., 1996). The male reproductive system is particularly sensitive to a variety of environmental influences, including lifestyle, medicines, radiation, pollution, and toxicants. As a result, congenital abnormalities in infants and functional changes in adults may follow (Saradha & Mathur, 2006). The process of male reproduction is complex and involves the testes, epididymis, accessory sex glands, and related hormones. Spermatogenesis and steroidogenesis, two highly ordered and complex processes carried out by the testes, are essential for the continuation of life. With the assistance of somatic sertoli cells, the highly dynamic and coordinated process of spermatogenesis develops mature spermatozoa from undifferentiated stem cells within the seminiferous tubules of the testis (Hess & Renato, 2008). The testis is well-equipped with strong intrinsic defensive mechanisms that shield the spermatozoa from harm from other intrinsic or external causes as well as during and after their spermatogenic and post-spermatogenic journeys (D'Cruz et al., 2010). Semineferous tubules, Leyding cell nuclei, and epididymides all had much smaller nuclei, and sperm motility had significantly decreased as well. Reduced levels of sialic acid, fructose, and protein in the testicular and accessory organs are thought to be what caused the stoppage of spermatogenesis and androgen depletion (Parohit, 1999). Steroidogenesis takes place in the interstitial compartment, which is made up of Leydig cells (Ge et al., 2008). Following the spermatogenesis process, the spermatozoa travels from the testis to the ejaculatory ducts, experiencing a series of alterations that enable it to move, function, and connect with the zona pellucida of the female ovum (Litscher et al., 2009). When given to male rats, plant extracts have also demonstrated encouraging antifertility properties. Plants can have a variety of impacts on the male reproductive system to cause antifertility action, including antispermatogenic, post-testicular, spermicidal, sperm immobilising, antiandrogenic, etc (Shaik et al., 2017).

Through this review article we will try to know whether *C. roseus* shows antifertility activity which we can use as a herbal medicine for contraceptive. Apocynaceae family member *Catharanthus roseus* L. is a significant medicinal plant which is a dicotyledonous angiosperm (Ajaib et al.,2010). There are just two cultivars of *C. roseus* that are widely available, and these are the pink-flowered "Rosea" and the white-flowered "Alba" (Jaleel & Panneerselvam, 2007). Two pharmacologically active substances derived from *C. roseus* or *V. rosea*, vincristin and vinblastin, have long been known to inhibit reproduction (Joshi & Ambaye, 1986 and Murugavel & Akbarsha, 1991). When *V. rosea* extracts were given to rats in a variety of doses, changes in the seminiferous tubule and a decrease in the percentage of primary spermatocytes, round spermatocytes, and elongated spermatids were observed (Bustos & Lopez, 1973).

Chemical constituent

Tannins, steroids, saponin glycosides, cardiac glycosides, anthraquinone glycosides, and flavonoids are all present in *C. roseus* (Yadav et al., 2013). It resulted in pathological alterations in the principal, apical, and nuclear cells of the caput and cauda, impairing epididymal functioning (Averal et al., 1996 and Murugavel et al., 1989). Apart than spermatogonia, it also affected spermatogenic cell lines (Murugavel & Akbarsha, 1991). *Catharanthus roseus* Linn. Leaf extract taken orally led to widespread testicular necrosis, tubule hyalinization, and scrotal cell-only syndrome. Studies on biochemistry found that the quantities of fructose and glycogen in reproductive organs had significantly decreased (Mathur & Chaudan, 1985).

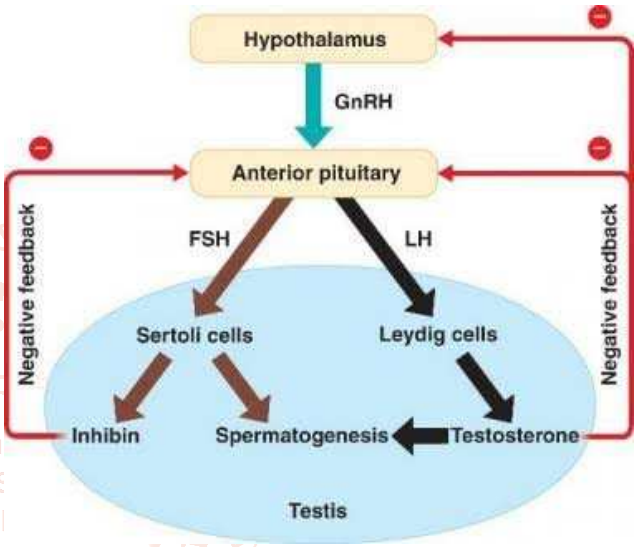
***C. roseus* as medicinal herb for anti-fertility**

Effect on sertoli cells

Throughout adulthood, the somatic sertoli cells play a critical role in regulating the spermatogenesis process. By controlling the movement of essential nutrients and growth factors across the tight junctions, they support the development of the germ cells (Griswold, 1998). The quantity of sertoli cells also influences the rate and quality of spermatogenesis (Petersen & Soder, 2006). Consequently, any substance that impairs the sertoli cells' survival and functionality may have a significant impact on spermatogenesis (D'cruz et al.,2010).

Affect leydig cells and steroidogenesis

In addition to spermatogenesis, the testis also produces androgens, which are essential for maintaining spermatogenesis. The hypothalamus, pituitary gland, and testis are all involved in a feed-back mechanism that controls the hormonal regulation of spermatogenesis (Sofikitis et al., 2008). Gonadotropin-releasing hormone, which is produced and secreted by the neurons of the hypothalamus, triggers the generation and release of LH and FSH from the pituitary gland. LH triggers the creation of testosterone in the testis' Leydig cells, which has an adverse feedback effect on the pituitary and hypothalamus' release of hormones. As a result of FSH's action on sertoli cells, androgen-binding protein is produced, which facilitates testosterone transit through Sertoli-Sertoli junctional complexes (Dufau et al., 1984).



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Antispermatogenic effect

In the male swiss albino mice, the *C. roseus* aqueous extract exerts antispermatogenic effects. The number of sperm and the proportion of motile sperm were lower in the mice treated with this extract than in the control group. The treated mice's dead sperm contained more than the control. Little activity was produced when male mice were given 0.2 ml/animal of a hot water extract of dried leaves (Murugavel et al., 1989). At 10.0 mg/animal, seminiferous tubules and Leydig cells regress, testicular cholesterol increases, and all germinal elements degenerate (Murugavel & Akbarsha, 1991). Male rats were given intraperitoneally active total alkaloids from whole plants (Joshi & Ambaye, 1968).

Antifertility effect

Male rats given an oral dose of a dried leaf and stem extract diluted in methanol and water (1:1) showed activity (Anon, 1979).

Affect sperm count, mortality & morphology

It lowers serum testosterone levels and sperm counts, which may result in infertility and death in users (Shaw et al., 2017).

Study of C. roseus in anti-fertility till date:

S. No	Plant part	Year	Animal modal	Extract	Effect	References
1.	Whole plant	1968	Male Rat	Alkaloids	Antifertility	Joshi and Ambaye
2.	Leaves	1983	Rat	Aqueous extract	Antispermatogenic activity	Chinoy and Ranga
3.	Leaves	1985	Mice	Aqueous extract	Antifertility efficacy	Mathur and Chaudan
4.	Leaves	1989	Mice	Aqueous extract	Antispermatogenic activity	Murugavel et al.
5.	Leaves	1991	Mice	Aqueous extract	Antispermatogenic	Murugavel and Akbarsha
6.	Leaves	1992	Albino Rat	Aqueous extract	Presence of multinucleated giant cells, spermatogenic arrest	Stainley and Akbarsha
7.	Whole plant	1993	Rat	Vincristine	Regression of entire reproductive system	Stainley et al.
8.	Whole plant	1995	Rat	Vincristine	Decrease in secretory acitivity of accessory sex gland	Akbarsha et al.
9.	Whole plant	1996	Rat	Vincristine	Epididymal dysfunction	Averal et al.
10.	Leaves	2009	Mice	Petroleum ether extract	Antiestrogenic activity	Gupta
11.	Whole plant	2017	Male Rats	Ethanolic extract	Antispermatogenic	Singh and Teotia
12.	Leaves	2017	Male Albino Rats	Aqueous extract	Antifertility	Shaw et al.
13.	Leaves	2019	Male wistar Rat	Vincristine	Depletion of sperm in epididymis	Sonawane et al.

Conclusion

C. roseus show different medicinal properties like antibacterial, antifungal, antiviral, antidiabetic and many more. It contains various alkaloids which are helpful in treatment of diseases. Plant is very effective and also easily available for any treatment of diseases. This review article focusses on detail study of anti-fertility property of *C. roseus.*

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