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Jatropha Curcas L As Anti-Fertility Agent: A Review

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Abstract

Introduction: The use of natural ingredients as contraception has long been known to the Indonesian people, especially in rural areas, where people still inherit the habits of their ancestors. The plants used as contraception contain compounds that are antifertility, antiimplantation, and antiestrogenic for both women and men. The purpose of this study was to determine the effectiveness of the *Jatropha curcas L* as an antifertility agent with the approach of several previous studies.

Methods: The method of this review used Prisma guidelines with scientific article searches using the Pubmed database, Google Scholar, and Science direct. A search was done on Pubmed with keywords Jatropha curcas [MeSH Terms] AND antifertility, Google scholar with keywords Jatropha curcas AND antifertility, Science direct with keywords Jatropha curcas AND antifertility

Findings: The results of this review of several research articles that have been reviewed indicated that the effectiveness of Jatropha (*Jatropha curcas L*) has an effect as an antifertility agent.

Conclusions: In short, there is a significant effect of using *Jatropha curcas L* as antifertility in the research finding. The implications of the research can be implemented as the contraception for male.

Keywords: Jatropha curcas L, Anti-fertility, Agent.

Introduction

One of the problems that the Indonesian government has not been able to overcome until now is the problem of population density. It is because the population continues to grow every year. The increase in population is increasingly troubling because it is not in line with the increase in welfare. The increase in population will not only complicate efforts to increase and equalize people's welfare in the food sector, but also education, health, employment, and housing. Therefore, the government makes the Family Planning program a part of national development.

One of the Sustainable Development Goals (TPB) 3 is to reduce the global maternal mortality ratio to less than 70 per 100,000 live births, with no country

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having a maternal mortality rate more than twice the global average. Severe postpartum hemorrhage, infection, high blood pressure during pregnancy (pre-eclampsia and eclampsia), complications from childbirth, and unsafe abortion are the main complications that cause almost 75% of all maternal deaths[1]. The indicator to be achieved in improving public health status is a decrease in the maternal mortality rate from 359 per 100.00 live births in the 2012 IDHS to 306 per 100,000 live births in 2019[2].

The use of contraception is closely related to the success of family planning. Family planning has become less effective due to the lack of male participation. There are still many doubts about the potential of male contraceptives. Currently, there are no male contraceptive products that meet the requirements, namely safe, comfortable, effective, cheap, reversible, and acceptable. Efforts to obtain male contraceptive materials derived from plants have been widely studied, but the results have not been satisfactory, so that its application to humans is still in doubt. Therefore, the priority of research still refers to the use of plant materials considering that medicinal materials derived from plants have advantages such as low toxicity, less side effects, easy to obtain, and cheap in price [3]. Various types of plants have been studied. One of which is Jatropha (*Jatropha curcas L*) which has an effect on the reproductive system of male animals, so it can be used as a male contraceptive.

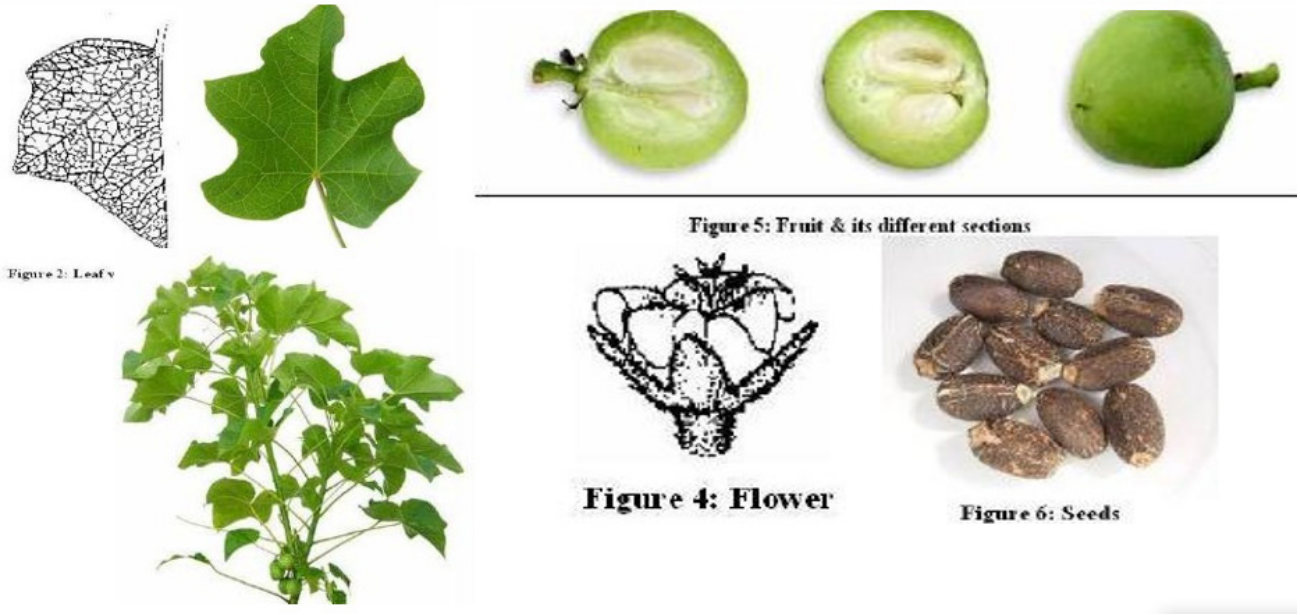

Figure 1: Plants, leaves, flowers, fruits and seeds of Jatropha curcas L [Sources: [4]]

Jatropha (Jatropha curcas) is a plant that belongs to the Euphorbiaceae family. This plant has a high economic value because the seeds produced can be useful for medicinal raw materials and producing oil. According to Laxane et. al. (2013)[4] Jatropha curcas (Jatropha curcas) has various pharmacological activities including castor seeds used for disinfectant, anti-parasitic, wound treatment, antifertility agent, and so on. According to Airaodion et. al. (2020)[5], Jatropha curcas reduces sperm quality and lowers levels of male reproductive hormones. Therefore, the writer wanted to know the effectiveness of Jatropha curcas L as an antifertility agent.

Methods

The method of this review used Prisma guidelines[6], with scientific article searches using data based on Pubmed, Google Scholar and Science Direct. A search was done on Pubmed with the keywords Jatropha curcas [MeSH Terms] AND antifertility, Google scholar with the keywords Jatropha curcas AND antifertility, Science direct with the keywords Jatropha curcas AND antifertility, then screened for publication of articles from 2011-2021, full text, research articles, recurring and theme-related publications detailed .

Findings

After finding the articles from PubMed search, Science Direct and Google Scholar, then they were filtered according to the inclusion criteria. It was begun with the identification of the articles. A total of 5436 articles were screened by looking at complete text articles becoming 1991 articles. Then there were 1869 articles which were not research content not used, so they became 122 articles. Of the 122 articles, there were 85 articles not selected because they were the repeated publication carried out again with criteria related to the theme. So that the final number obtained was 27 articles. The research was carried out in several countries such as: Indonesia, India, Nigeria, Mexico and others who discussed the effect of Jatropha curcas L as an antifertility agent.

Research conducted by Arini (2012)[7] aims to see the antifertility effect of 70% ethanol extract of Jatropha (Jatropha curcas) seeds in vivo. Giving ethanol extract of Jatropha seeds with doses of 5mg/kg BW, 25mg/kg BW, and 50mg/kgBW for 48 days to male rats can reduce spermatozoa, testicular weight and seminiferous tubule diameter statistically when compared to control animals. In addition, the administration of extracts at doses of 5mg/kg BW, 25mg/kg BW, and 50mg/kgBW for 48 days in male rats can affect the process of spermatogenesis, which is indicated by a decrease in the number of spermatocytes and the number of Sertoli cells.

Empirically it is reported that several countries such as Cambodia, Vietnam and India have used castor seeds as an ingredient that can cause abortion, while in Sudan castor seeds are used as contraceptives. Compounds found in castor seeds that have the potential as antifertility ingredients are known as jatrophones[8]. Research from Puspitadewi (2007)[8] stated that oral administration of jatropha seed powder at a dose of 0.2 g/head/day in mice with a treatment period of 14 days showed that the antifertility effect of castor bean did not have a significant effect on changes in uterine profile, both the weight of uterus and the thickness of endometrial. Jatropha curcas fruit is also able to reduce sperm motility and count and has an abortive activity[8].

The mechanism of antifertility agents found in Jatropha (Jatropha curcas) has not been known with certainty. There are two possible mechanisms of action of these antifertility agents, namely through the hormonal system or directly reacting to the reproductive organs. Based on the previous research, it is shown that there was effectiveness of jatropha curcas as an antifertility agent.

1. Effects of Jatropha curcas on hormones

Jatropha seed ethanol extract has antifertility activity in female rats at which steroid activity was reported[9]. The chemical constituents of Jatropha seeds are fatty acids, sterols, campesterol, stigmasterol, beta-sitosterol, delta 5- avenasterol. Beta-sitosterol is the largest component contained in Jatropha seeds. In another study, the serum testosterone concentration was tested on day 0 and day 49. Testosterone concentration test results show that there is a decrease in testosterone concentration at low doses which can cause a decrease in the quality of spermatozoa because the function of the hormone testosterone, among others, affects the maturity of spermatozoa[10].

The hormone testosterone is very important in men for the development and maintenance of male reproductive tissues, namely the testes, epididymis, seminal vesicles, and penis[10]. Consumption of phytosterol compounds in excess amounts can cause an increase in plasma testosterone levels because the phytosterols in the body will be converted into testosterone. Beta-sitosterol compounds have a chemical structure similar to the hormone testosterone, which is a cyclopentane perhydrophenantrene-core hydrocarbon compound. An ingredient can work as a hormone because it contains substances whose molecular structure is similar to that of a hormone [11]. Thus, it is suspected that beta-sitosterol also acts like testosterone.

Saponins and alkaloids are the raw materials for steroid hormones. It is suspected that this compound is involved in the steroid hormone biosynthesis pathway, resulting in the formation of a compound with a structure similar to testosterone. This compound is anti-testosterone, binds to testosterone receptors in the seminiferous tubules so that testosterone does not function[12] and causes disruption of spermatogenesis. The same thing was reported by Nurliani, Anni.; Rusmiati and Heri Budi Santoso

(2005)[13] that saponins and alkaloids are used as raw materials for the synthesis of steroid hormones, and triterpenoids have a biogenesis link with steroids. It is suspected that saponins, alkaloids and triterpenoids are involved in the biosynthetic pathway of steroids, especially testosterone, resulting in the production of materials with a structure similar to testosterone. Anti-androgen agents act competitively at target tissue receptor sites to block the action of androgen steroids. Allegedly these compounds are anti-androgenic.

Increased testosterone in the blood will result in negative feedback on the hypothalamus. This feedback mechanism is a way of working hormonal contraception that can inhibit the process of spermatozoa maturation. High testosterone levels cause a negative feedback mechanism to the hypothalamus and pituitary. Testosterone will inhibit the hypothalamus to produce GnRH so that GnRH levels fall and inhibit the anterior pituitary to produce FSH and LH. When FSH decreases, there is a disturbance in the Sertoli cells which causes a reduction in nutrients needed for proliferation, differentiation and maintenance of spermatogenic cells. When LH levels drop, the testosterone produced is also reduced. The sperm count and testosterone concentration are kept constant by a feedback mechanism. If a negative feedback mechanism occurs, the levels of FSH and LH in the blood circulation decrease and the next result is that the spermatogenesis process stops and the number of spermatozoa produced will decrease.

2. Effects of Jatropha curcas on reproductive organs

Jatropha has the activity of terminating pregnancy, anti-inflammatory, anti-metastatic, anti-coagulant, disinfectant, wound healing[14]. Jatropha leaf extract induces multiple contractions in the uterus of pregnant rats after in vivo and in vitro administration . Jatropha curcas fruit has abortion and contraceptive activity. Giving castor seed powder solution is thought to affect the reproductive organs, especially changes in the uterine profile.

The administration of a solution of jatropha seed powder containing the antifertility agent jatrophone with a subchronic dose of 0.2 g/head/day did not have the potential to affect changes in the uterine profile of Swiss Webster mice. Jatropha seeds are used as contraception or trigger abortion in South Sudan[15]. The antifertility effect of them is thought to be due to the presence of jatrophone as a cytotoxic agent[4]. Jatrophone action is known through inhibition of the protein kinase C pathway.

Conclusion

Based on the theoretical description and Literature research findings above, it can be concluded that: There are two possible mechanisms of action of these antifertility agents, namely through the hormonal system or directly reacting to the reproductive organs. Based on the previous research, it is shown that there is the effectiveness of jatropha curcas as an antifertility agent.

Suggestion

Regarding to the results of our findings in this review, it is necessary to do a further research on the isolation of compounds to determine the structure of compounds that play a role in antifertility activity in *Jatropha curcas L*. It can be developed as a basic ingredient of traditional male or female contraceptive.

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Conflict of Interest: The authors have declared that there is no conflict of interest in term of results of publication as well.

Ethical Clearance: Not required

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