The Effect of Purple Eggplant Extract Administration on the Number, Motility, and Vitality of Spermatozoa in Male Sprague Dawley Rats

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Abstract. *Background:* Rapid and low-quality population growth will become a burden for development which makes it difficult for the government to fulfill basic human rights such as education, health, and employment for the people. Without any efforts of intensive prevention, humans will be trapped in poverty and ignorance. There are only two types of effective male contraceptives or also known as male birth control in the world namely condoms and vasectomy so that more varied male contraceptives are necessary. Purple eggplant has been studied and has a benefit for antifertility.

Objectives: To determine the effect of purple eggplant extract in reducing the number, motility, and vitality of spermatozoa in male Sprague Dawley rats.

Method: This study used the Randomized Post Test Only Control Trial design. The research population was 28 male Sprague Dawley rats aged 3 months weighing 200-250 grams and were divided into four groups: control group, the first group with a dose of 10 mg/kg body weight, the second group with a dose of 10 mg/kg body weight, the second group with a dose of 50 mg/kg body weight, the third group with a dose of 50 mg/kg body weight.

Results: The results of the ANOVA test for the mean number or the average of the numbers of spermatozoa cells in the treatment group obtained a value of P = 0.362 (P> 0.05) so that it can be concluded that there is no significant difference in the mean number of spermatozoa cells between the three treatment groups. The results of the Kruskal Wallis test analysis for the mean number of spermatozoa motility in the treatment group obtained f count 8.647 with a value of P = 0.034 (P <0.05) so that it can be concluded that there is a significant difference in the mean number of spermatozoa motility between the four treatment groups. One-way ANOVA test in this study found f = 8.836 with a value of P = 0.012 (P <0.05) and therefore it can be concluded that there is a significant difference in the spermatozoa vitality between the four treatment groups.

Conclusion: There is an effect of purple eggplant extract administration in reducing the number, motility, and vitality of spermatozoa in male Sprague Dawley rats.

Keywords: Purple eggplant extract, number of spermatozoa, spermatozoa motility, and spermatozoa vitality

Introduction

A low-quality population will become a burden for development, especially a large number of them will make it difficult for the government to fulfill basic human rights such as education, health, and employment for the people. If the family planning program is not taken seriously and the birth rate does not decrease, there will be a population explosion or rapid population growth amounts to 267.1 million people in 2015 in Indonesia.

The number of male family planning (KB) program acceptors in Indonesia is still far from the target number. Nationally, there are only 2% of male family planning acceptors from about 40 million couples of childbearing age (PUS) in Indonesia. This figure is still far from expectations as the target for 2007 is 4.5 percent.

Forty-five percent of women of childbearing age who are married practice contraception worldwide. Nevertheless, significant variations are depending on the region. For example, more than 70% in the United States and China but only 6% in Nigeria. Female

sterilization and the IUD (Intrauterine Device) are the most popular methods in developing countries. Meanwhile, oral contraceptives and condoms are mostly used in developed countries. Less than 15% of women of reproductive age worldwide use oral contraceptives and more than half live in the United States, Brazil, France, and Germany.

The problems in the developing world are evident. The ability to regulate fertility has a significant effect on infant, child, and maternal mortality and morbidity. Pregnant women are 200 times more likely to die in developing countries than in developed countries. The health risks associated with pregnancy and childbirth in the developing world are far more concerning than the risks associated with using modern contraceptives.

The increasing number of population growth in Indonesia is alarming. Without any prevention such as an intensive family planning program, it will cause rapid population growth and people will be trapped in poverty and ignorance. One of the solution is to increase the use of contraceptives and provide all the available methods.

The participation of a man/husband in family planning is the responsibility of the man/husband in participating in family planning as well as having healthy and safe sexual behavior for himself, his partner, and his family. It can be done directly and indirectly. Participation of men/husbands directly (as a Family Planning participant) is a man/husband using one of the methods or methods of preventing pregnancy, such as condoms, vasectomy (male sterilization), and natural family planning that involves men/husbands (interrupted intercourse or withdrawal method and periodic abstinence method) The problem with condoms is that sometimes partners are allergic to rubber condoms, condoms can only be used once, and psychologically condoms can cause discomfort. Expired condoms are more likely to break or tear. The problem with a vasectomy is that complications (such as bleeding, pain, and infection) are possible. It does not protect partners from sexually transmitted diseases including HIV/AIDS. It must use condoms for 12-15 times of intercourse so that the seminal cells become negative and in people who have psychological problems in sexual relations, it makes things worse. The limitation of periodic abstinence from intercourse is very long which causes feelings of disappointment and sometimes results in the partner being unable to obey. It is not suitable for women who have irregular menstrual cycles and it takes 6 to 12 menstrual cycles to determine the fertile window.

BKKBN has conducted a study on male contraceptive pills by using gandarusa leaves. This research has reached the third stage and will be mass-produced and marketed in Indonesia. The objective was to increase male participation in family planning.

The current research uses experimental animals because experimental animals are in the same class as humans, namely animals from the mammal class. The experimental animal used was the Sprague Dawley rat because this animal has physiology and anatomy of the organs similar to humans.

Literature Review

Similar to gandarusa leaves, purple eggplant has been known to have anti-fertility benefits and has many benefits for our body. It is not only popular as food, soft-flesh vegetables like sponges.

A study conducted in Banjarmasin examined the effect of eggplant on the testosterone levels using a dose of 5 gr, 10 gr, 15 gr and results in testosterone level of 33.3; 32.9; 32.5; and 31.6 ng/dl. This shows a tendency the reduce testosterone levels. The decrease tendency in testosterone levels occurs due to the effects of Solasodine as a steroid alkaloid that can be disruptive to the Leydig cell membrane permeability as a producer of testosterone. The disruption of Leydig cell membrane permeability results in the transfer of nutrients as an energy source for testosterone biosynthesis is also disrupted, resulting in a decrease tendency in testosterone levels.

A study conducted in Surakarta using a model of 20 male mice aged 8 weeks were divided into the control group and three treatment groups. This study shows the effect of purple eggplant juice on the decrease of spermatid. The higher the dosage the higher the decrease in the number of spermatids.

A study was conducted in Semarang using the research subject of 20 samples of normozoospermic. Each sample is divided into four groups; 1 control group and 3 treatment groups. Decreased motility, viability, and sperm membrane integrity were found in the highest dose group.

Materials and Methods

This study was pure experimental research where the treatment group was administered to purple eggplant extract. The research design used a randomized post-test only control trial design. The research population was male Sprague Dawley rats. This research used experimental animals namely male Sprague Dawley rats which are widely used in general research and research in the field of reproduction.

Maintenance and research of experimental animals and measurements of the number, motility, and vitality of spermatozoa were carried out at the Laboratory of Veterinary Medicine, Gadjah Mada University. The research implementation was planned for 30 days with one treatment every morning. Analytical and statistical analysis was performed in a different test between treatment groups on the number, motility, and vitality of spermatozoa. If the distribution was normal, then the Oneway Anova test was performed, followed by a Post-Hock Test. If it is not normal, then the Kruskal Wallis test was performed.

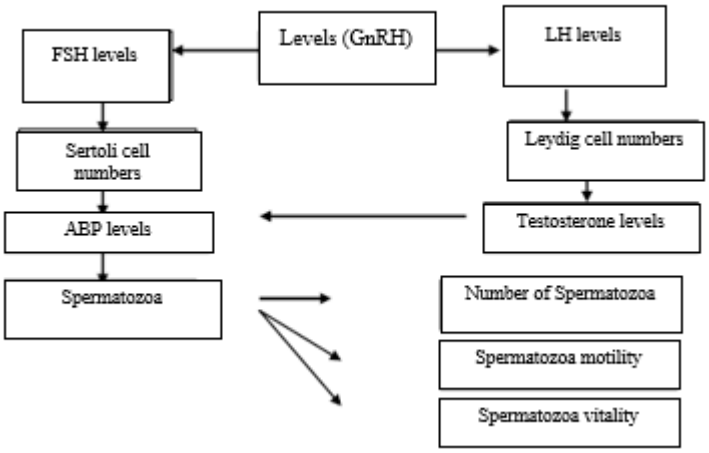

Figure 1. Theoretical framework

Results and Discussion

The results of the ANOVA test on the mean of spermatozoa in the treatment group obtained f = 1,131 with a value of P = 0.362 (P>0.05). Therefore, it can be concluded that there is no significant difference in the spermatozoa vitality between the four treatment groups. A study conducted by Kapsul examined the effect of eggplant on testosterone levels by using a dose of 5 gr, 10 gr, 15 gr results in a testosterone level of 33.3; 32.9; 32.5; and 31.6 ng/dl. This shows a tendency the reduce testosterone levels. The decrease tendency in testosterone levels, due to the effect of Solasodine as a steroid alkaloid which can disrupt the Leydig cell membranes permeability as a producer of testosterone. The disruption in the Leydig cell membrane permeability results in the transfer of nutrients as an energy source for testosterone biosynthesis is also disturbed and therefore resulting in a tendency the reduce testosterone levels.

Decreased testosterone in the blood will result in negative feedback to the hypothalamus, making the hypothalamus secretes GnRH resulting in the GnRH unable to suppress the anterior pituitary so that the anterior pituitary secretes follicle-stimulating hormone (FSH) and luteinizing hormone (LH). FSH acts to stimulate the testes and spur the spermatocytogenesis process, in which the spermatogonia develop into spermatids. LH acts to stimulate the testes and spur the spermiogenesis process, in which the spermatids develop into spermatozoa. In this study, the mechanism for the inhibition of spermatogenic cell development was a decrease in the number of cells, which is thought to be closely related to the decrease in FSH, LH, and testosterone.

The results of the analysis of Kruskal Wallis test for the mean number of spermatozoa motility in the treatment group obtained an f count of 8.647 with a value of P = 0.034 (P<0.05). Therefore, it can be concluded that there is a significant difference in the mean number of spermatozoa motility between the three treatment groups. The analysis was followed by the Post Hoc Test with significance degree $\alpha = 0.05$ to determine the difference in the mean number of spermatozoa cells between the 2 groups.

There is a significant difference between the control group and the second treatment group with a value of P = 0.027 (P<0.05), and there is a significant difference between the control group and the third treatment group with a value of P = 0.015 (P <0.05).

The results of the analysis of the ANOVA test for the mean number of spermatozoa vitality in the treatment group obtained f = 8.836 with a value of P = 0.012 (P <0.05). Therefore, it can be concluded that there is a significant difference in the spermatozoa vitality between the four treatment groups. The analysis was followed by a post hoc test with a significant degree of $\alpha = 0.05$ to determine the spermatozoa vitality between the 2 groups.

The decrease of spermatozoa motility is caused by the alkaloid substances in purple eggplant which can interfere with the activity of dynein protein which is one of the proteins found in the spermatozoa tail. Dynein protein contains ATPase. So that ATP-ase is disrupted, it will disrupt the sodium and calcium homeostasis and hence motility disrupted the spermatozoa.

Alkaloid compounds (solasodine) can also disrupt the activity of the ATPase enzyme in the sperm cell membrane. ATPase is in the middle of the tail ("Middle Piece") of the sperm and acts to maintain internal homeostasis for sodium and potassium ions. Sperm motility is highly dependent on the composition of sodium and potassium ions. Thus, if the activity of the ATPase enzyme is disrupted, the homeostasis of sodium and potassium ions will also be disrupted, and hence sperm motility will also be impaired.

The results found a significant difference between the control groups and the second treatment group with a value of P = 0.002 (P<0.05). There is a significant difference between the control group and the third treatment group with a value of P = 0.001 (P<0.05). There is a significant difference between the first group and the second treatment group with a value of P = 0.03 (P<0.05). There is a significant difference between the first treatment group and the third group with a value of P = 0.02 (P <0.05).

Functionally, the epididymitis is highly dependent on the testosterone hormone. It is a known fact that testosterone is needed for the spermatozoa vitality in the epididymitis. The disturbance of hormones due to the administration of purple eggplant extract results in the decrease of spermatozoa vitality and therefore many spermatozoa die.

Conclusions

From the results of this study, it can be concluded that The extract of purple eggplant reduces the number, motility, and vitality of spermatozoa in male Sprague Dawley rats; The administration of purple eggplant extract at a dose of 150 mg/kg body weight resulted in a lower number of spermatozoa in male Sprague Dawley rats than the dose of 10 mg/kg body

weight and 50 mg/kg body weight; The administration of purple eggplant extract at a dose of 150 mg/kg resulted in a lower spermatozoa motility in male Sprague Dawley rats than a dose of 10 mg/kg body weight and 50 mg/kg body weight; The administration of purple eggplant extract at a dose of 150 mg/kg body weight resulted in a lower spermatozoa vitality in male Sprague Dawley rats than a dose of 10 mg/kg body weight and 50 mg/kg body weight; The administration of purple eggplant extract at a dose of 150 mg/kg body weight is better to reduce the number, motility, and vitality of spermatozoa in male Sprague Dawley rat than a dose of 10 mg/kg body weight and 50 mg/kg body weight.

It is suggested that it is necessary to conduct further research with dose conversion in humans; It is necessary to know the effect of purple eggplant extract on the FSH, LH, and testosterone hormones; It is necessary to conduct further research on the side effects of purple eggplant extract. It is necessary to develop purple eggplant extract as male birth control pills.

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