



Spermatozoa Abnormality Test of Boer Goats Frozen Semen with the Addition of Sweet Orange Essential Oil and Streptomycin in Tris Yolk Extender

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

This research aims to determine the percentage value of spermatozoa abnormalities in Boer Goat frozen semen by adding a combination of streptomycin with sweet orange essential oil to tris yolk extender. The ingredients used in this study were fresh semen from Boer Goat, tris yolk extender, streptomycin, and sweet orange essential oil. Tris yolk extender is made using Tris (hydroxymethylaminomethane) (3.32 g), citric acid (1.86 g), fructose (1.37 g), glycerol (6 ml), egg yolk (20 ml), aquabides (100 ml). The study design was a non factorial completely treatments given were the addition of sweet orange essential oil at 0%, 0.25%, 0.5%, 0.75% and 1%. The results showed that the addition of a combination of streptomycin and sweet orange essential oil into the tris yolk extender had a highly significant effect ($P < 0.01$) on the percentage value of spermatozoa abnormalities of Boer Goats before and after freezing. The best average value of spermatozoa abnormalities is the addition of sweet orange essential oil at 1% (P4) with the percentage of spermatozoa abnormalities before freezing at 3% and after freezing at 6%.

Keywords: *Boer goat; essential oil; frozen semen; streptomycin; sweet orange; spermatozoa abnormality test.*

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1. INTRODUCTION

Opportunities for export of goats are high, especially on Eid al-Adha. However, at present Indonesia has not been able to meet this demand due to the limited goat population and low local Indonesian goat weight. Local goats have a body weight between 18-20 kg, while the minimum requirement for goat body weight for exports is 25 kg. For this reason, it is necessary to consider how to improve genetic quality, especially the body weight of goats in Indonesia.

Reproductive technologies such as Artificial Insemination can be a solution to increase population and genetic quality of livestock. Artificial Insemination can enhance the use of semen from a superior buck to inseminate many does. Another benefit of Artificial Insemination is that it minimizes the danger of disease transmission and does not require a lot of buck for insemination and is usually a good quality frozen semen because it comes from a superior buck.

The Boer Goat is one of the superior goats whose sperm can be used for the Artificial Insemination program. Boer goats have advantages such as high body weight and high litter size. Indonesian local goats, despite their low body weight, have advantages such as being able to adapt to extreme environmental conditions. With the Artificial Insemination program, it is expected to obtain offspring of goats with high body weight that can adapt in Indonesian environment and obtained from Boer Goats and Local Goats.

The success of the Artificial Insemination program in goats would depend on the quality of the frozen semen [1]. One of the causes of the low spermatozoa survival during frozen semen storage is caused by the bacteria. Bacteria in sperm can damage spermatozoa so that it will increase the percentage of spermatozoa abnormalities. The addition of antibiotics in frozen semen extenders is done to minimize bacterial growth. Provision of antibiotics such as streptomycin in goat semen extender had been practiced for a long time. But the results are still considered unfavorable, so efforts should be made to suppress bacterial growth. In this research an attempt was made to combine the antibiotic streptomycin with sweet orange peel essential oil which could be used as an antibacterial because it contains limonene and linalool which are toxic to bacteria. The addition of sweet orange essential oil can improve the

quality of frozen semen of the Goat Boer [2]. The research hypothesis is the addition of a combination of sweet orange essential oil and streptomycin in the tris yolk extender can reduce the percentage of abnormal spermatozoa. This study objectives to determine the percentage of spermatozoa abnormalities with the addition of a combination of sweet orange essential oil and streptomycin in the tris yolk extender.

2. METHODOLOGY

The research material is Boer Goat semen to which had been added tris yolk extender, streptomycin and various levels of sweet orange essential oil with the treatments given as follows:

- P₀ = Streptomycin + Sweet Orange Essential Oil 0%
- P₁ = Streptomycin + Sweet Orange Essential Oil 0.25%
- P₂ = Streptomycin + Sweet Orange Essential Oil 0.5%
- P₃ = Streptomycin + Sweet Orange Essential Oil 0.75%
- P₄ = Streptomycin + Sweet Orange Essential Oil 1%

The research method is carried out experimentally with quantitative or objective approaches. Experimental research was carried out by making several treatments using various levels of sweet orange essential oil and comparing them to that without sweet orange essential oil (control). Activities in this experimental research aim to assess the effect of the addition of sweet orange essential oil or test the presence or absence of their influence on that addition when compared to without the addition of sweet orange essential oil. The research design used was a non factorial completely randomized design with 5 treatments and 5 replications.

The parameter observed was evaluation of spermatozoa abnormalities in frozen semen before freezing and after freezing, by observing deviations in the morphological shape of spermatozoa which can reduce the spermatozoa fertility. Abnormalities investigated were head too big, head too small, double head (duplicate head), circular tail and double tail. The percentage of abnormality was calculated using the formula:

$$\text{Abnormality} = \frac{\text{abnormal spermatozoa}}{\text{total number of sperm count}} \times 100\%$$

3. RESULTS AND DISCUSSION

Abnormal sperm counts were carried out with the use of slides mounted under the microscope. The research results of spermatozoa abnormalities in frozen semen of Boer Goats before and after freezing can be seen in Table 1.

The results showed decreases in the quality of spermatozoa during freezing and thawing. Spermatozoa motility after the cooling process has decreased, this decrease was caused by egg-yolk coagulating enzyme factors in goat semen plasma which are toxic, as well as due to cold shock [3].

Abnormality is a condition in which spermatozoa have defects in one or all parts of the body of spermatozoa [4]. Primary abnormalities occur during the process of spermatogenesis or testicular disorders, secondary abnormalities occur after spermatozoa leave the seminiferous tubules into the male reproductive tract, whereas tertiary abnormalities occur after ejaculation to the handling process.

The results of the analysis of variance showed that the effect of adding a combination of streptomycin with sweet orange essential oil as a diluent had a very significant effect ($P < 0.01$) on spermatozoa abnormalities both before and after freezing. Further test results showed that the minimum/ least abnormality was found in the P4 treatment of 3% before freezing and 6% after freezing.

Decreased spermatozoa motility is also caused by treatments that cause damage and death of spermatozoa. During the thawing process spermatozoa are susceptible to cell damage due to sudden changes in osmotic pressure caused by rapid thawing. Only few spermatozoa had the ability of a strong plasma membrane to survive [5].

Spermatozoa with normal acrosomes will be significantly reduced after the process of freezing and thawing [6]. Temperature changes can cause changes in spermatozoa cell membrane permeability and result in disharmonism, membrane breakdown, and enzyme removal. This condition can cause an increase in spermatozoa abnormalities [7].

The number of abnormal spermatozoa is increasing, causing low fertility of semen. Defective spermatozoa cells, although they can fertilize eggs, usually end with the death of a child before birth [8]. Other factors that influence the increase in abnormalities are inadvertent actions at the time of treatment, diluting semen with a fluid that is not as isotonic, cold shock, heat, and nutritional disorders [9].

Spermatozoa that experience abnormalities are caused by physical influences at the time of treatment, where spermatozoa rub against each other, causing both abnormality and death [10]. Factors that influence the abnormal percentage are inadvertent actions to dilute semen with a fluid that is not as isotonic, cold shock, heat, nutritional disorders or endocrine disorders that affect normal spermatogenesis [11]. During the freezing and storage of membranes there is a membrane imbalance, which can reduce the resistance of spermatozoa so that after thawing the quality of the semen becomes low [12].

Seasonal factors can affect the abnormality of goat spermatozoa. In winter and spring abnormalities of goat spermatozoa have the highest percentage. The best results are in the summer due to abnormalities in minimum goat spermatozoa. However, the influence of seasons in general does not really affect the quality of sperm because the value of the percentage of abnormalities in all seasons is still within the range that is accepted for normal fertility [13].

Table 1. Average percentage of spermatozoa abnormalities in Boer Goat semen before and after freezing

Parameter	Treatment	Abnormal sperm counts (%)	
		Before freezing	After freezing
Abnormalities	P ₀	8±0.59	13±1.37
	P ₁	7±1.24	10±1.37
	P ₂	5±1.15	9±0.72
	P ₃	4±0.69	8±1.24
	P ₄	3±1.24	6±1.56

Explanation: Different superscripts in the column show very significant differences ($P < 0.01$)

The sweet orange essential oil contains flavonoids which can function as antioxidants. The addition of antioxidants can reduce the percentage of spermatozoa abnormalities in goat semen. The addition of antioxidants is highly recommended because it can protect the sperm acrosome and morphology [14].

4. CONCLUSION

The use of a combination of sweet orange essential oil and streptomycin in the Boer Goat semen extender that was best used was the addition of 1% sweet orange essential oil which can reduce the value of the percentage spermatozoa abnormality in frozen semen Boer Goat.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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