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Effect of Administration of Different Concentrations of Bran in Fermetodege Feed on the Sheep Spermatozoa Quality

Pengaruh Pemberian Konsentrasi Dedak dalam Pakan Fermetodege terhadap Kualitas Spermatozoa Domba

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Abstract. The objective of this study was to detemine the effect of rice bran on fermented feed towards the quality of sheep semen based on the viability and motility of spermatozoa. This study was experimental type that applied completely randomized design which is divided into three treatments, with five repetitions for each treatment. Each treatment represented the concentration of rice brain in sheep feed, namely 10%, 20%, and 30%, respectively. The test subject in the study were five Gibas sheeps which had been observed for 20 weeks. The results of this study indicated the rice bran with a concentration of 30% had the best effect on viability and motility of spermatozoa, namely 42±1.41 dan 47±0.83. Based on these results it can be concluded that rice bran influenced the quality of sheeps semen.
Key words: rice bran; fermetodege; sheeps; semen quallity

Abstrak. *Tujuan penelitian ini untuk menguji pengaruh konsetrasi dedak padi dalam pakan fermetodege yang mempengaruhi viabilitas dan motilitas spermatoza domba. Penelitian ini bersifat eksperimental yang menggunakan rancangan acak lengkap yang terbagi menjadi tiga perlakuan, dengan setiap perlakuan memiliki pengulangan sebanyak lima kali. Konsentrasi dedak padi pada pakan domba masing-masing 10%, 20%, 30%. Ternak uji yang digunakan adalah Domba (Ovis aries) sebanyak lima ekor dan dilakukan pengamatan selama 20 minggu. Hasil penelitian menunjukan dedak padi dengan konsentrasi 30% memiliki pengaruh yang paling baik terhadap motilitas dan viabilitas spermatozoa, yaitu sebesar 42±1.41 dan 47±0.83. pemberian dedak padi menunjukan adanya pengaruh terhadap kualitas semen domba.*
Kata kunci: *dedak padi; domba; fermetodege; kualitas semen*

INTRODUCTION

Sheep are livestock widely cultivated by communities in general. Sheep offer various benefits in the form of milk, meat, hides, wool, and as offerings in religious and customary ceremonies (Fahmi et al., 2015). According to data from the Ditjen PKH (2018), meat production from 2015 to 2025 is expected to increase by 16%, and global meat consumption is projected to rise by 1.3 r.w.e (retail weight equivalent), thereby supporting the potential for sheep exports. For this reason, it is crucial to enhance the quality of sheep livestock sustainably.

Improvements in sheep productivity can be achieved through the application of biotechnology, such as Artificial Insemination (AI), which offers several advantages. Setiawan (2018) reported that AI enhances genetic quality by using superior males, prevents disease transmission, and is relatively cost-effective and time-efficient. Additionally, Tagama (2005) noted the benefit of having breeding records for farm management. The success rate of AI is influenced by various factors, one of which is the quality of the semen used. The quality of semen in AI is affected by several factors, including the age of the livestock, body weight, environment/season, and nutrition (Heriyanta et al., 2014; Khairi et al., 2014; Khairi, 2017; Sunami et al., 2017). The feed consumed by male livestock is used to enhance stamina and the quality of the reproductive system (Sumadiasa et al., 2017). Providing high-quality feed can improve semen quality in the AI process (Khairi et al., 2014).

Feed must contain nutrients that can support the physiological functions required for semen productivity. The inclusion of Vitamin E, Zn, and Se prevents the decline in motility and

concentration of spermatozoa (Yunsang and Wanxi, 2011). Nutritional restrictions can also delay sexual maturity (Khairi et al., 2014). Yunsang and Wanxi (2011) reported that feeds conducive to good semen production contain Zn, retinol, vitamins D, E, B9, B12, folate, Ni, Se, Cu, Mn, Cr, carnitine, fatty acids, arginine, and protein. Therefore, the development of sheep feed in Indonesia must consider these nutritional factors.

In smallholder farms, sheep feed often utilizes agricultural waste. Agricultural by-products that can be processed into feed for sheep include corn cobs, rice straw, sugarcane tops, bran, and water hyacinth (Fitrihidajati et al., 2015; Yulianti et al., 2018; Hastuti and Awami, 2011). The use of agricultural waste in livestock feed accounts for about 25-30% of the total feed composition (Zainaldi et al., 2017). Water hyacinth contains inorganic materials such as Cr, Ca, Na, K, P, N, and ash content (Kusrinah et al., 2016). Fitrihidajati et al. (2015) stated that water hyacinth contains 11.2% protein, making it a potential livestock feed. Isnawati (2019) reported that corn cobs have a protein content of 5.6%, which is higher than that of rice straw at 4.9%. The fermentation of corn cobs and water hyacinth can be used as supplementary feed for ruminants (Fitrihidajati et al., 2015). Bran contains 17.67% crude fiber, 9.9% crude protein, and 57.4% TDN (Anggraeny et al., 2017). The provision of a mixture of tofu dregs, bran, corn, and soybean meal has shown an increase in spermatozoa concentration (Zainaldi et al., 2017).

Utilizing agricultural waste as feed often faces challenges due to its low nutritional value. Nutritional value can be enhanced through fermentation methods. Nutrient levels can increase through the fermentation process due to chemical changes caused by microbial metabolism (Mustafa et al., 2017). The administration of fermented corn cobs to PO cattle has shown an increase in body weight (Gustiani and Permadi, 2015). A fermented mixture of tofu dregs, corn, bran, and soybean meal has shown an increase in spermatozoa concentration and a decrease in abnormal spermatozoa (Zainaldi et al., 2017). Feeding fermented feed from water hyacinth, tofu dregs, and water spinach to female goats has resulted in a higher number of offspring compared to conventional feed and improved the quality of male goat spermatozoa (Ratnasari et al., 2019). Fermented water hyacinth has shown an increase in nutritional value, such as dry protein (Nababan et al., 2013). Protein in water hyacinth plays an important role in spermatozoa formation because the structure of spermatozoa is composed of DNA and nucleoprotein (Syauqy, 2014). Additionally, micro-mineral elements in water hyacinths such as Cr, Ca, Na, K, P, and N, affect the reproductive performance of ruminants (Yanuartono et al., 2016).

The use of fermented feed from water hyacinth still has drawbacks. The high crude fiber content in water hyacinth results in low digestibility in livestock (Fitrihidajati et al., 2015). This low digestibility leads to lower energy acquisition by the livestock, impacting their metabolism and reproductive functions, thus necessitating the addition of bran to the feed mix. Bran has potential as a supplement in alternative feed due to its sufficient nutritional value. Tompas et al. (2016) reported that a mix of bran and fermented water hyacinth improved digestibility in ducks. Bran serves as a source of protein and carbohydrates in feed (Nurcahyani et al., 2017). The nutrients in rice bran, including vitamin B, protein, Ca, and P, play roles in livestock metabolism, including reproductive metabolism. Feeds high in protein content can enhance semen quality (Saputra et al., 2017). A deficiency in protein affects reproductive performance, resulting in prolonged ejaculation times and decreased libido. The protein content in bran ranges from 11-13% (Wibawa et al., 2015). Sujono (2001) reported that adding fermented bran to poultry feed increased the weight of Arabian chickens and improved spermatozoa quality. The reproductive process in livestock requires a minimum of 7% crude protein content (National Research Council, 2000). Therefore, bran holds the potential as an additional component in fermented feed.

Based on this background, further research is needed to determine the effectiveness of using fermented feed from water hyacinth, corn cobs, and bran (Fermetodege) by manipulating the concentration of bran to assess its impact on the quality of ram semen in terms of viability and motility of spermatozoa.

MATERIALS AND METHODS

This study was an experimental investigation conducted on male sheep divided into three treatment groups, each consisting of five rams. Group A received a Fermetodege feed treatment with a 10% bran concentration, Group B was treated with Fermetodege at a 20% concentration, and Group C was given Fermetodege with a 30% concentration. The feed was administered for 20 weeks, with semen collection occurring in the final week of the study. Data on the average motility and viability of

spermatozoa were then analyzed using quantitative descriptive methods. The equipment used in this study included a cutting machine, grinding machine, shovel, 5 cc and 3 cc syringes, measuring cups, plastic bags, a steamer, baskets, and a gas stove. The materials used were water hyacinth plants, corn cobs, and bran, each in quantities of 50 kg, along with molasses, water, probiotics, and inoculum. The study involved several stages, as follows.

Fermentation method for water hyacinth: a) Water hyacinth was chopped into 3 ± 5 cm lengths using a cutting machine; b) corn cobs were ground into coarse powder using a grinding machine; c) chopped water hyacinth was sun-dried for two days, being turned periodically until the moisture content was approximately 20%, calculated by subtracting the weight after drying from the initial weight, divided by the initial weight multiplied by 100%; d) 1 kg each of water hyacinth and corn cobs were weighed for each of the 50 treatments and placed on a plastic base; e) the amount of bran included in the feed followed the proportions of the water hyacinth and corn cob mixture, at 10%, 20%, and 30%; f) a bacterial starter of 0.6 grams per experimental unit, 300 cc of molasses, 50 cc of probiotics, and 750 cc of water were prepared; g) the mixture of water hyacinth, corn cobs, and bran was then cooked for 1 hour; h) the ingredients, including water, molasses, and probiotics, were homogenized and added to the mixture of water hyacinth, corn cobs, and bran while stirring; i) The mixture was allowed to cool and placed on transparent plastic; j) The mixture was then covered tightly with plastic for five days.

$$Moisture\ Content = \frac{a-b}{a}\ X\ 100\%$$

Moisture content calculation formula (Fitrihidajati et al., 2015)

Fermetodege feed was administered to male sheep for five months, provided both in the morning and evening. The total Fermetodege feed given was 15% of the overall feed provided to the sheep. The feeding regimen involved giving livestock 2% of the sheep's body weight in feed, twice daily over 20 weeks. After 20 weeks of feeding Fermetodege, semen collection was conducted to assess motility and viability (Ratnasari et al., 2019).

Semen collection was performed in the morning. The males designated for semen collection were brought to a restraining pen and exposed to a teaser to enhance libido. An artificial vagina prepared with lubricant gel was positioned immediately when the male mounted the teaser to collect the semen, which was then immediately tested for motility and viability (Susilawati, 2013).

Motility tests were conducted by counting spermatozoa that showed forward progressive movement. Freshly collected semen in a test tube was mixed with 0.9% NaCl and homogenized using a vortex mixer. The semen was then placed on a glass slide and observed under a microscope at 400x magnification. The spermatozoa observed were those moving forward. The results were assessed in percentages ranging from 0 to 100 (Ducha et al., 2013).

The viability of spermatozoa was assessed by creating a smear with eosin-nigrosin staining. Semen and eosin-nigrosin were dropped on the edge of a glass slide, and another slide edge was placed on the slide with the semen and eosin-nigrosin, then pulled to the end, creating a thin smear along the slide which was then air-dried. The smear was observed under a microscope at 400x magnification, and a count of 100 spermatozoa was performed. Live spermatozoa appeared white, while those that were dead appeared red (Ducha et al., 2013).

RESULTS

Sheep fed Fermetodege with varying concentrations of bran exhibited different motility and viability values. The results, showing the motility and viability of ram spermatozoa by manipulating the bran concentration in Fermetodege, are presented in Table 1.

The administration of different bran concentrations significantly affected ram spermatozoa motility, with significance values of 0.00 ≤ 0.05 (Table 1). Giving branwith different concentrations gives a real effect on spermatozoa motility. The average motility values, from highest to lowest, were 42 ± 1.41 (D3), 35 ± 3.46 (D2), and 33.2 ± 1.30 (D1). According to Duncan's test, the best treatment was obtained with a 30% bran concentration (42 ± 1.41).

Based on the data obtained, different concentrations of bran significantly influenced the viability of ram spermatozoa, with significance values of 0.00 ≤ 0.05. This is supported by Duncan's test, which indicated significant differences in each treatment, with average viability values from

highest to lowest of 37.2 ± 1.30 (D1), 46 ± 0.70 (D2), and 47 ± 0.83 (D3). The best viability value was achieved with a 30% bran concentration.

Tabel 1. Motility and viability values of ram spermatozoa at different bran concentrations in Fermetodege.

Bran Concetration	Average Motility and Viability	
	Motility	Viability
Bran 10% (D1)	33.2±1.30[a]	37.2±1.30[a]
Bran 20% (D2)	35±3.46[a]	46±0.70[b]
Bran30% (D3)	42±1.41[b]	47±0.83[c]

Note : Different letters in Duncan's test indicate significant differences ($p<0.05$). The bran concentrations administered showed an impact on the quality of ram semen (viability and motility).

DISCUSSION

Spermatozoa motility refers to the ability of spermatozoa to move forward (progressively) within a fluid. The motility values in this study were above 32%, thereby categorizing the spermatozoa as progressive. This aligns with the research by Desi et al. (2018), which states that spermatozoa are considered progressive if their motility exceeds 32%. The progressive movement of spermatozoa in all treatments is presumably due to the availability of sufficient energy or ATP for the reproductive process. Hafez and Hafez (2000) noted that the energy for spermatozoa motility is derived from the breakdown of ATP in the mitochondria located in the middle part of the spermatozoa tail. The motility of ram spermatozoa, which was enhanced by the addition of bran in the Fermetodege feed, indicates the presence of sufficient ATP in the rice bran. This is because bran contains about 53% carbohydrates, which are a source of ATP formation (Hadipernata et al., 2012; Pramono and Tagama, 2008). The increased motility values in sheep fed with higher bran concentrations indicate that the nutrients in the bran present in Fermetode are sufficient to enhance motility.

Skoracka et al. (2020) reported that foods containing Zn, Se, Mg, Mn, Ca, and Cu support motility and spermatogenesis. This is consistent with findings from Saputra et al. (2017), which highlighted that rice bran contains the minerals Mg and Ca, and also Mn, Se, and Zn (Astawan and Febrinda, 2010), making it adequate for enhancing motility. Rice bran also contains phenolic compounds such as flavonoids, triterpenoids, alkaloids, and saponins (Moko et al., 2014). Phenolic compounds function as antioxidants capable of binding free radicals to prevent damage to spermatozoa, thus improving motility values (Khaki et al., 2011).

The study demonstrates a significant difference in the composition of bran in Fermetodege feed on the viability percentage of ram spermatozoa, indicating an optimal spermatogenesis process within the seminiferous tubules (Zainaldi et al., 2017). This process is related to the energy derived from the consumed feed. Dethan et al. (2010) reported that livestock fed with high-protein diets showed an increase in the viability of spermatozoa. Rice bran, containing protein levels between 11-13%, effectively enhances spermatozoa viability. Moreover, the protein content in rice bran plays a role in the synthesis of hormones and enzymes involved in spermatogenesis, particularly testosterone (Cahyadi et al., 2016). Testosterone is essential for maintaining spermatogenesis, and a testosterone deficiency can halt the spermatogenesis process (Hasbi and Gustina, 2018).

Viability relates to the assessment of the integrity of the spermatozoa membrane structure (Sukmawati et al., 2014). Bran contains other nutritional elements that can improve spermatozoa viability. It includes vitamins E and B complex, which function as antioxidants that bind free radicals, thereby reducing damage to spermatozoa (Astawan and Febrinda, 2010). Additionally, the availability of Zn in bran acts as an antioxidant that inhibits free radicals from damaging spermatozoa, thereby enhancing viability (Widhyari et al., 2015).

CONCLUSION

Based on the research conducted, it can be concluded that administering Fermetodege feed with varying bran concentrations over 20 weeks enhances the motility and viability of spermatozoa in male sheep. Rams that received a 30% bran concentration in their feed exhibited the best viability and motility values among the treatments, with motility at 42 ± 1.41 and viability at 47 ± 0.83.

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