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Research Paper

Production performance and blood profile of Ongole crossbred cattle receiving *Saccharomyces cerevisiae* supplementation

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ABSTRACT: *This study aims to determine the effect of Saccharomyces cerevisiae supplementation on production performance rations, including feed intake, body weight gain, feed efficiency, and Ongole crossbreed cattle's blood profile. The research material used 20 male Ongole crossbreed cattle with an average age of 2-2.5 years, initial body weight in the range of 135-200 kg/head with almost the same body conditions score, namely the range of 5-6 on a scale of 9. Cows were divided into two groups, with ten each. The first group was given a company ration, and the second group was given a treated ration (company ration with the addition of 0.5% Saccharomyces cerevisiae from the concentrate dry matter). This study used an experimental method using a t-test to compare livestock production performance and for blood profiles described descriptively. The results showed that the company ration + SC had higher feed intake, body weight gain, and feed efficiency than the company ration (P<0.05). Blood profile of Ongole crossbreed cattle supplemented with Saccharomyces cerevisiae in the ration showed higher numbers for HDL, glucose, total protein, albumin, and lower levels for total cholesterol, LDL, and triglyceride levels compared to blood profiles without Saccharomyces cerevisiae supplementation.*

KEYWORDS: *blood profile, feed efficiency, feed intake, Ongole crossbreed cattle, Saccharomyces cerevisiae*

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I. INTRODUCTION

The performance of beef cattle can be improved by arranging rations balanced and following their nutritional needs. A good feed has high digestibility so that it is easily absorbed by livestock. One of the efforts to increase digestibility in the rumen is the addition of feed additives. Feed additives currently popular in increasing livestock production and health are probiotics that can replace antibiotics [1]. The addition of probiotics in the ration can stimulate microbial growth in the rumen and improve feed digestibility in ruminants [2].

Generally, the probiotics used by breeders in Indonesia come from bacteria and fungi, but fungi are still not optimally utilized. One type of fungus that can be used is yeast or single-celled fungi. The advantage of using yeast is that it is effortless to isolate and easy to produce and its facultative anaerobic nature. The results of previous studies showed that *Saccharomyces cerevisiae* (yeast) has excellent potential as a probiotic ingredient for ruminants and has been tested in vitro and in vivo [3] and [4].

Utilizing tofu dregs with the addition of corn cobs as a concentrate feed ingredient and rice straw as a substitute for forage is an alternative feed that can be used as animal feed [5]. Especially for areas that are increasingly narrower to obtain forage. In order to increase the digestibility of crude fiber, the addition of probiotics in the ration needs to be done so that it can stimulate microbial growth in the rumen so that it can automatically increase the consumption and supply of nutrients to the intestine, which in turn can increase the overall production response [6]. This study examines the effect of *Saccharomyces cerevisiae* supplementation in rations on the production performance and blood profile of Ongole crossbred cattle at the Dua Sarana livestock company, Lubuk Alung District, Padang Pariaman Regency, West Sumatra, Indonesia.

II. MATERIALS AND METHODS

Ethics Statements

This experiment was conducted according to the Guideline for ethics study of experimental animals based on the law of the Republic of Indonesia number 18 of 2009 about Animal livestock and animal husbandry.

Research Place

The *in vivo* test on Ongole crossbreed cattle was carried out at the Dua Sarana livestock company, Lubuk Alung District, Padang Pariaman Regency, West Sumatera Province, Indonesia. *Saccharomyces cerevisiae* originated from the Microbiology Laboratory of the Bogor Agricultural Institute and was later rejuvenated at the Laboratory of Feed Industry Technology, Faculty of Animal Husbandry, Andalas University. Blood sample tests were carried out at the Biochemistry Laboratory of the Faculty of Medicine, Andalas University.

Research Material

The material used in this study was 20 bulls of Ongole Crossbreed cattle with initial body weights ranging from 135-200 kg with an average age of 2-2.5 years, and the body conditions score almost the same, namely the range of 5.5 - 6 in the range of numbers 1-9 [7]. The rations used in this study were company rations as control and company rations supplemented with *Saccharomyces cerevisiae* (0.5 % of concentrate dry matter) as treatment rations. The company rations (control) consisted of concentrate (tofu dregs and corn cobs) and rice straw. Corn cobs used are corn cobs that have been finely ground and then mixed with tofu dregs before being given to cattle. Seven kg of concentrate is given at 08.00 am while 3 kg of rice straw (in fresh weight) was given at 5 pm. The chemical composition of concentrate and rice straw can be seen in Table 1**.**

Table 1. The chemical composition of forages and concentrates used by the company

Chemical Composition*	Rice Straw	Concentrates
Dry matter, %	92.00	86.00
Crude protein, %DM	5.31	9.00
Crude Fiber, %DM	32.14	38.61
Ether extract, %DM	3.32	6.20
Ash, %DM	22.25	10.20
Nitrogen free extract, %DM	36.69	35.95

*DM: dry matter.

Research design and statistical analysis

This study used an experimental method and descriptive method by comparing groups of cows using rations supplemented with *Saccharomyces cerevisiae* and those using rations without *Saccharomyces cerevisiae*. The parameters measured were production performance (feed intake, body weight gain, and feed efficiency) and blood profile (total cholesterol, High-density lipoprotein (HDL), glucose, total protein, albumin, low-density lipoprotein (LDL), and triglyceride). The data obtained from the calculations were analyzed statistically using the independent sample t-test using the formula and calculated using statistical data processing software Microsoft Excel 2013 [8]. Meanwhile, the blood profile was described descriptively.

Research Implementation

The adaptation period was carried out for 14 days, while data collection was for 30 days. During the data collection period, feed intake, body weight, and blood samples were collected. Feed Intake is calculated every day by reducing the ration given with the remaining ration during the collection period. Bodyweight is done on days 1 and 30, in the morning before feeding. Blood samples taken were cow blood samples that did not use *Saccharomyces cerevisiae* in the ration and those that used *Saccharomyces cerevisiae*. The working procedure of taking blood serum is before the cattle are given breakfast (fasting). Blood samples were collected through the jugular vein using a 10 ml syringe and placed in a vacutainer. Blood serum was separated using centrifugation at 3000 rpm for 10 minutes. Analysis of glucose levels, total protein, albumin, triglycerides, total cholesterol, HDL, and LDL was carried out using the HumaStar 80® Auto Analyzer. Furthermore, the blood sample was tested for total cholesterol, triglyceride, LDL, HDL, glucose, total protein, and albumin.

Calculation formula:

$$Feed\ Intake = Feed\ Given - Remaining\ Feed$$

$$Average\ Daily\ Gain = \frac{Final\ Weight - Initial\ Weight}{Research\ Time}$$

$$Feed\ Eficiency = \frac{Average\ Daily\ Gain}{Feed\ Intake} x100\%$$

III. RESULT

Production Performance

Supplementation of *Saccharomyces cerevisiae* in the ration has a different significant effect ($p<0.05$) on production performance (feed intake, body weight gain, and feed efficiency). Rations that received additional *Saccharomyces cerevisiae* were able to increase feed intake and body weight gain for Ongole crossbreeds cattle and had a higher feed efficiency level than rations without Saccharomyces cerevisiae supplementation. The study of feed intake, body weight gain and feed efficiency fed experimental diets is shown in Table 2.

Table 2. The production performance of the ration supplemented with *Saccharomyces cerevisiae* (Sc).

Parameters	Treatments*	
	Company Ration	Company Ration + Sc
Feed Intake (Kg/head/day)	$6.60^{a} \pm 0.91$	$6.85^{b} \pm 0.75$
Bodyweight gain (Kg/head/day)	$0.52^{a} \pm 0.15$	$0.92^{b} \pm 0.19$
Feed efficiency (%)	$7.78^{a} \pm 1.75$	$13.49^{b} \pm 2.13$

^{a,b}:means in the same row with varying superscript differ significantly ($P<0.05$); *Sc: *Saccharomyces cerevisiae.*

Blood Profile

Blood profile of Ongole crossbreeds cattle supplemented with *Saccharomyces cerevisiae* in the ration showed higher numbers for total cholesterol, HDL (good cholesterol), glucose, total protein, and albumin lower levels for LDL (bad cholesterol) and triglyceride levels compared to the profile. Blood of Ongole crossbreed cattle without *Saccharomyces cerevisiae* supplementation. The study of blood profiles of Ongole crossbreed cattle fed experimental diets is shown in Table 3.

Table 3. Blood profile of the ration supplemented with *Saccharomyces cerevisiae* (Sc).

Parameters*	Treatments**	
	Company ration	Company Ration + Sc
cholesterol (mg/dl)	138.10	129.90
Triglycerides (mg/dl)	78.60	71.20
LDL (mg/dl)	50.10	34.30
HDL (mg/dl)	64.08	89.56
Glucose (mg/dl)	77.10	84.90
Total protein (g/dl)	6.40	7.13
Albumin (g/dl)	3.76	4.03

*LDL: low-density lipoprotein; *HDL: high-density lipoprotein; **Sc: *Saccharomyces cerevisiae.*

IV. DISCUSSION

Production Performance

Ongole crossbreed cattle that got Saccharomyces cerevisiae supplementation in their rations showed a higher feed intake ($P<0.05$) compared to Ongole crossbreed cattle without *Saccharomyces cerevisiae* supplementation (Table 2). It is probably due to Saccharomyces cerevisiae's role in modifying the rumen ecosystem by increasing the population and microbial activity in the rumen, resulting in increased digestibility. It is related to Payandeh and Kafilzadeh [9] opinion, which states that the addition of *Saccharomyces cerevisiae* in the ration can stimulate microbial growth in the rumen improve feed digestibility in ruminants.

The increase in feed intake offsets the increase in body weight. The increase in consumption was due to increased fiber digestibility rate and increased protein absorption's microbial flow rate. This result follows Ferrareto et al.'s [10] opinion, who reported that Saccharomyces cerevisiae could increase feed intake in livestock. Xiau et al. [11] stated that giving *Saccharomyces cerevisiae* can maintain the balance of the microbial composition in the digestive system of livestock, which will result in increased digestibility of feed ingredients and affect the health of livestock.

Saccharomyces cerevisiae's addition to stimulating cellulolytic bacteria's growth can also inhibit pathogenic bacteria's work [12]. The reduced activity of pathogenic bacteria in the rumen will maximize the development and activity of rumen microbes. The increasing number of rumen microbes can increase the degradation activity of feed organic matter into simple, soluble compounds, thereby increasing the absorption of organic substances. It is supported by the opinion of Kamel et al. [13], which states that there is an increase in the digestibility of organic matter with the addition of *Saccharomyces cerevisiae*. Chaucheyras-Durand et al. [3] reported that yeast Saccharomyces cerevisiae's culture could trigger rumen bacteria's growth, especially

cellulolytic bacteria and lactic acid bacteria. *Saccharomyces cerevisiae* in feed aims to create a balance of microorganisms useful in the degradation of nutritional components in the rumen [14].

Besides, feed intake is also influenced by the quality, quantity, and palatability of the livestock's feed itself and internal and external factors. Internal factors include genetics, gender, and health, while external factors include the weather's influence. *Saccharomyces cerevisiae* to livestock rations can improve palatability and quality of animal feed to increase feed intake. The aroma and taste caused by *Saccharomyces cerevisiae*'s addition to the ration can cause instincts and appetite for these animals to increase their consumption. It is supported by Pazla [15], which states that there is an increase in feed intake of sheep who get additional Saccharomyces cerevisiae in the ration. Ensminger and Olentine [16] added that the ration's chemical composition influenced feed intake. Feed that has good palatability will be consumed more by livestock.

Cows whose rations were given *Saccharomyces cerevisiae* had a higher body weight gain ($P<0.05$) than cows whose rations were without *Saccharomyces cerevisiae*. Table 2 shows that the body weight gain of cows that received supplementation with *Saccharomyces cerevisiae* 0.92 kg/head/day without supplementation was only 0.52 kg/head/day. *Saccharomyces cerevisiae* supplementation in cattle rations can increase the acceleration of microbial protein flow leaving the rumen, resulting in increased absorption of amino acids in the intestine [17]. It can accelerate protein formation in the muscles, impacting weight gain compared without supplementation with *Saccharomyces cerevisiae*. Arief et al. [18] and Nehru et al. [19] stated that probiotics are feed additives in the form of live microbes that can improve the balance and digestive function of host animals, manipulate digestive tract microbes to improve health conditions, and increase livestock productivity. The increase in body weight by probiotics is caused by increased dry matter and protein and dry matter digestibility [4]. Saccharomyces cerevisiae can stimulate rumen bacteria's growth, especially cellulolytic bacteria, affecting ration consumption and digestibility to affect body weight gain. Suryani et al. [20] stated that one of the benefits of Saccharomyces cerevisiae in ruminants, especially in adult livestock, is that it can affect meat production.

The t-test analysis results showed that the treatment had a significant effect on the ration's feed efficiency ($P <0.05$) (Table 2). The greater the ration efficiency value, the better and more efficient the ration is. Suyitman et al. [21] reported that the value of ration efficiency depends on the amount of feed intake, which can provide body weight gain. Furthermore, lactic acid production and utilization of *Saccharomyces cerevisiae* in the rumen are near related to feeding efficiency and animal health. Besides, it was also reported that Saccharomyces cerevisiae could stimulate growth factors, such as organic acids or vitamins, thereby stimulating cellulolytic bacterial populations and lactic acid bacteria in the rumen [22].

Saccharomyces cerevisiae's mechanism use was secreting the enzymes α-galactosidase and β-glucosidase. It attacked saccharide compounds' bonds to break down oligosaccharide compounds into simple sugars and possibly release bound nutrients. By saccharide compounds, it is open to digestive enzymes [23]. Saccharomyces cerevisiae for rumen cellulolytic bacteria is a growth factor because it can provide many needed nutrients such as vitamins, minerals, and amino acids [24]. The increasing number of cellulolytic bacteria population will streamline the digestion of high fiber feed ingredients such as rice straw and palm oil [25] and [15].

The feed intake in this study was higher than the results of the research Keyser et al. [26] who obtained the value of feed intake supplemented with *Saccharomyces cerevisiae*, namely 5.52 kg/head/day, but lower body weight gain and fed efficiency, namely 1.18 kg/head/day and 21.38%. This difference in value is caused by differences in concentrate and forage used and experimental cattle.

Blood Profile

Blood cholesterol for Ongole crossbreeds cattle using rations supplemented by *Saccharomyces cerevisiae* was lower, namely 129.90 mg/dl, compared to total blood cholesterol without *Saccharomyces cerevisiae,* which was 138.10 mg /dl. These results indicate that Saccharomyces cerevisiae can lower total blood cholesterol. According to Frandson [27], cholesterol in the blood depends on feed intake, age, gender, and unsaturated fatty acid consumption. In this study, cow blood cholesterol was still in the normal range, namely 80-170 mg/dl [28]. Cholesterol is a waxy substance found in blood fats. Cholesterol is vital for forming cell membranes, vitamin D, bile acids, and certain hormones, but if cholesterol levels are high, it will cause blockages in blood vessels that are at risk to the heart [27].

Triglycerides in the blood serum of Ongole crossbreds cattle that did not use *Saccharomyces cerevisiae* were higher (78,60 mg/dl) than those who used Saccharomyces cerevisiae (71,20 mg/dl). Similarly to the opinion of Sarwono et al. [29] that probiotics can reduce triglycerides because probiotics can effectively reduce the activity of acetyl Co-A carboxylase, an enzyme that plays a role in the rate of fatty acid synthesis. Factors that increase triglyceride synthesis and LDL secretion by the liver contain lots of carbohydrates, high circulation of free fatty acids, high insulin levels, and low glucagon levels [30].

Saccharomyces cerevisiae supplementation for lower LDL (34.30 mg/dl) than blood LDL, not using Saccharomyces cerevisiae (50.10 mg/dl). At the same time, HDL was higher (89.56) than without

supplementation (64.08). Likewise, Sumardi et al. [31] are stated that the provision of local probiotics can increase good cholesterol (HDL) levels and reduce harmful cholesterol levels.

HDL is a good fat that acts as a cleanser for excess cholesterol in the tissue. High HDL levels in the blood will speed up transporting cholesterol to the liver, reducing the possibility of cholesterol accumulation in the blood vessels. Supplementation of *Saccharomyces cerevisiae* in the ration showed HDL of Ongole crossbred cattle was higher than that of cattle without *Saccharomyces cerevisiae* supplementation. HDL is synthesized in the liver and is regulated by blood cholesterol content, while *Saccharomyces cerevisiae* plays a more significant role in the rumen to help metabolize feed fat into fatty acids carried by the blood in the form of chylomicrons. According to Bouchart [32], HDL is synthesized and secreted by the liver as discoidal particles, which become spherical during the formation of cholesterol esters with the help of the LCAT (lecithin: cholesterol acyltransferase) enzyme. Hasanudin et al. [33] stated that HDL is a lipoprotein that maintains the balance of cholesterol to not accumulate in cells. The balance is maintained by removing sterols from the membrane with the same amount of cholesterol synthesized to the liver. This study's HDL levels were still within the normal range, namely 40-90 mg/dl [34].

Saccharomyces cerevisiae supplementation tends to increase total protein (7.13 g / dl), albumin (4.03 g/dl), and blood glucose (84.90 mg/dl), compared without *Saccharomyces cerevisiae* supplementation, namely total protein (6.40 g / dl), albumin (3.76 g / dl) and blood glucose (77.10 mg/dl). The increase in total protein indicates a positive thing that there is a decrease in the proteolytic process in the rumen by inhibiting the conversion of amino to ammonia. Glucose is the final and main product of the digestion of carbohydrates that circulate with the blood. Apart from being a source of energy, glucose in ruminants is also crucial in maintaining body cells, especially blood and muscle. Blood glucose levels in this study are still in the normal range. According to Happer et al. [35], glucose levels in ruminants ranged from 70 to 120 mg/dl. Low blood glucose levels can also spur an increase in blood cholesterol levels. Guyton and Hall [36] stated that insulin secretion would be inhibited in low blood glucose levels, and blood cholesterol concentrations will increase. The total value of protein, albumin, cholesterol, and glucose in this study was almost the same as the value obtained in the blood profile study of Prihatno and Gustari [37] Ongole crossbreed cattle, which received protein total of 7.29 g / dl, albumin 3.52 g / dl, cholesterol 121.53 mg /dl, and glucose 54.1 mg/dl.

V. CONCLUSION

Supplementation of *Saccharomyces cerevisiae* in rations can increase body weight gain, feed intake, feed efficiency, HDL (good cholesterol), glucose, total protein, and albumin and reduce total cholesterol, LDL (bad cholesterol), and triglyceride levels in the blood profile of Ongole crossbreed cows.

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