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Hematological Profile of Beef Cattle After Consuming Concentrate Feed Supplemented with Depolarized Katuk Leaf (*Fedtugrow*®) in Local Farmers

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ABSTRACT

***Fedtugrow*® is a complete feed containing depolarized *katuk* (*Sauropus androgynous*) leaves and is beneficial for enhancing the productivity of both dairy and beef cattle. Depolarization technology in katuk leaves involves the removal of polar compounds from the leaf to eliminate the potential side effects resulting from katuk consumption, such as bronchiolitis obliterans and inhibition of calcium absorption. This technology could eliminate side effects without compromising the efficacy of katuk leaves in increasing milk production and body weight gain. This study aimed to evaluate the efficacy of *Fedtugrow*® in promoting the growth of beef cattle and its impact on the health status of the cattle raised on smallholder local farms with distinct characteristics compared to commercial farms. Ten Limousin male cattle entering the fattening phase were divided into a control group that consumed standard concentrate and a treatment group that consumed *Fedtugrow*® for three months. Blood was collected at the end of treatment for hematological analysis, including erythrocyte and leukocyte profiles. Cows consuming *Fedtugrow*® showed a significantly higher average daily gain and lower stress index than the control. Furthermore, no significant differences were observed in the hematological profile, such as total erythrocyte count, hemoglobin level, hematocrit, and total leukocytes. This study showed the ability of *Fedtugrow*® as a growth promoter without negatively affecting the physiological status of beef cattle raised on smallholder farms.**

Keywords: Beef cattle, *Fedtugrow*®, hematology, smallholder local farm

INRODUCTION

The status of Lampung Province as a national livestock center is supported by Central Lampung Regency, whose livestock population is close to 50% of the total cattle population in Lampung province (Badan Pusat Statistik Provinsi Lampung 2023). In addition to beef cattle breeding and cultivation companies, in general, the beef cattle fattening business in Lampung Regency is carried out by the community with a small ownership scale (5–10 heads) and is a source of side income among the community (Maimunah *et al*. 2021). Smallholder farmers face several limiting factors in increasing their business capacity, such as time constraints, limited land resources, and limited access to technology. An increase in the number of livestock not followed by increased livestock resources can lead to a decline in livestock health and welfare (Hasan and Baba 2014). Smallholder farmers face several limiting factors in increasing their business capacity, such as time constraints, limited land resources, and limited access to technology. An increase in the number of livestock that is not followed by an increase in livestock resources can potentially lead to a decline in livestock health and welfare

Katuk depolarization is a technology developed to eliminate polar compounds in katuk leaves that are suspected to cause side effects from katuk leaves. Polar compounds in katuk leaves have been reported to harm the absorption of calcium and phosphorus in lactated sheep (Suprayogi 2017) and cause a decrease in eggshell thickness (Saragih 2016). At the experimental level, the polar compounds of katuk leaves can inhibit cell growth and stimulate both necrotic and apoptotic cell death (Yu *et al*. 2007). Katuk depolarization can eliminate these side effects without reducing the efficacy of katuk

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leaves in increasing milk and meat production (Tarigan *et al*. 2023).

In contrast to the polar compounds that inhibit energy metabolism, the nonpolar compounds in katuk leaves are anabolic steroids, which are beneficial for increasing livestock productivity. These nonpolar compounds stimulate the fermentation of rumen microbes in the region to produce more Volatile Fatty Acids (VFAs) through various metabolic pathways, such as the Krebs cycle, increasing rumen protein synthesis, and cross-feeding bacteria (Suprayogi 2005; Suprayogi 2017). In addition to having an impact on energy production, the papaverine compound in katuk leaves increases the absorption of nutrients in the small intestine because it reduces the motility of the digestive tract, increases the contact time between nutrients and the intestinal wall (Badoni *et al*. 2012), and increases blood flow on the surface of the intestine (Brzozowski et al. 1993). In addition to increasing meat production, the leaves are also able to improve the quality of meat and dairy products by lowering meat fat and cholesterol levels (Santoso 2001; Letis *et al*. 2017), improving the physical quality of meat (Ferasyi *et al*. 2019), and improving the taste of milk (Sutomo *et al*. 2020). Depolarized katuk leaves increased milk production by 35.21% without negatively impacting cattle (Suprayogi *et al*. 2013; Tarigan *et al.* 2023).

To date, no information is available on the effectiveness of depolarizing cattle (Fedtugrow®) on the productivity and physiological status of beef cattle raised on farms. Smallholder farmers have several limitations, such as cage conditions and seed quality, which can hinder the efficacy of depolarized katuk. This study aimed to evaluate the ability of depolarized katuk (Fedtugrow®) to increase the body weight and maintain the health status of beef cattle raised on smallholder farms through hematological analysis.

METHODS

Location and Design

This experiment was carried out in a cage owned by a farmer at the Andini Jaya Tiasmojo People's Farmers School (SPR), Astomulyo Village, Punggur District, Central Lampung Regency, which is located at an altitude of 40 m above sea level (masl) for three months (September–November 2022). During the study period, the average temperature, relative humidity, and Temperature-Humidity Index (THI) were 29.15 ± 2.33°C, respectively; 86.15 ± 13.31%; and 82.17 ± 2.36, respectively. A total of 20 cattle were randomly selected with male criteria, aged 18–18 months, Limousin type, clinically healthy, entered the fattening phase, had no history of foot and mouth disease (FMD), and had been vaccinated against FMD. The cows were then divided into two groups: the control group that was given control concentrate and the treatment group that was given 2% depolarized katuk pellets (v/v) or Fedtugrow®. The depolarised katuk concentration in the concentrate was selected from the optimal dose obtained from previous research (Suprayogi *et al*. 2013; Suprayogi 2017). The results of the proximate analysis of the control concentrate and Fedtugrow® are presented in Table 1. There was no difference in nutritional value between the control concentrate and Fedtugrow®. Compared with the concentrate, the forage feed was a mixture of pineapple peel and *onggok* (fermented tapioca waste) at 4:1. Feed was given twice a day, a total of 10% of body weight, and met the nutritional adequacy standards of the National Research Council (NRC). Drinking water was provided *ad libitum*.

Data Collecting

The body weight of each cow was measured before the study and after 3 months of treatment, while blood collection was performed 3 months after treatment. Blood

Table 1 Average of nutrient composition in the concentrate used in the study

Nutrients	Types of concentrates	
	Control	Fedtugrow®
Dry materials (%)	86.33 ± 3.62	89.14 ± 1.08
Ash (%)	7.83 ± 1.95	9.49 ± 1.55
Crude protein (%)	18.60 ± 1.86	19.14 ± 1.07
Coarse fiber (%)	19.30 ± 5.41	17.89 ± 2.92
Crude fat (%)	6.40 ± 2.23	5.20 ± 1.25
Nitrogen-free extract ingredients (%)	35.86 ± 6.35	37.36 ± 5.70
Calcium (%)	1.05 ± 0.71	0.99 ± 0.67
Phosphorus (%)	0.68 ± 0.28	0.48 ± 0.19
Gross energy (Cal)	3.557.67 ± 468.30	3.750.67 ± 567.41

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samples were collected in the morning, and as much as 3 mL of blood was collected from the coccygea vein and directly stored in a tube coated with anticoagulant ethylenediaminetetraacetic acid (EDTA) for hematological analysis, which included the number of red blood cells (erythrocytes), hematocrit (packed cell volume/PCV), hemoglobin (Hb), number of white blood cells (leukocytes), and leukocyte differential (neutrophils, lymphocytes, eosinophils, basophils, and monocytes) at the Lampung Veterinary Center, Directorate General of Livestock and Animal Health, Ministry of Agriculture. The numbers of erythrocytes and leukocytes were calculated using the hemocytometer method, hemoglobin was calculated using the Ahli method, and hematocrit was calculated using the microcapillary method (Ghai 2012).

Data Analysis

Data on the production performance of beef cattle (body weight, body weight gain, and daily body weight gain) and hematological analysis (number of erythrocytes, hematocrit, hemoglobin, number of leukocytes, and stress index) in the control and treatment groups were analyzed by unpaired T test using GraphPad Prism version 8.0 (Motulsky 2007).

RESULTS AND DISCUSSION

Weight Gain

The administration of Fedtugrow® during the fattening period was proven to be able to increase (p<0.05) significantly the bovine body weight gain (Figure 1b) and the daily body weight gain of the cows (Figure 1c) compared to the control that was not given Fedtugrow®. This effect on body weight gain is possible because of the response of non-polarizing compounds to depolarization in the concentrate. Previous studies have reported that the non-polar fraction in katuk leaves, which is rich in anabolic steroid compounds, significantly increased the body weight of rats (Suprayogi *et al*. 2015) and rams (Suprayogi 2016). The non-polar compound androstane-17-one,3-ethyl-3-hydroxy-5 alpha found in the leaves (Suprayogi *et al*. 2001) is a precursor of steroid hormones such as progesterone, testosterone, estradiol, and glucocorticoids (Hashem *et al*. 2021), which signals the release of growth hormone from the posterior pituitary gland (Handayani *et al*. 2022). The administration of the leaf flour increased testosterone levels in male goats (Ferasyi *et al*. 2015). In addition to affecting the reproductive system, testosterone exerts a direct anabolic effect by increasing muscle protein synthesis. Testosterone has an indirect anabolic effect through increased secretion of IGF-1 (Insulin-like growth factor-1), which stimulates bone and muscle growth, as well as growth hormones and insulin, which trigger the transport of amino acids into cells (Skoupá *et al*. 2022).

Red Blood Cell Profile (Erythrocytes)

Erythrocyte profile showed that Fedtugrow® consumption did not affect the erythrocyte count (Figure 2a), hematocrit (Figure 2b), or hemoglobin levels (Figure 2c). It indicates that the active compounds in Fedtugrow® do not affect erythrocytes (erythropoiesis) production in the bone marrow or the presence (*life-span*) of erythrocytes in blood vessels.

Different results were obtained when katuk leaves were used. An increase in the number of erythrocytes, hemoglobin levels, and hematocrit was observed in rabbits (Akbar *et al*. 2013; Satiyana *et al*. 2021), rats (Suparmi *et al*. 2016), and buffaloes (Roza *et al*. 2015) fed katuk leaf flour in the feed. This difference is most likely due to polar compounds in the leaves. Polar extracts of katuk leaves have higher protection against erythrocytes than non-polar extracts because they have higher inhibition of hemolysis, oxidation of hemoglobin, and peroxidation of fats (Purba and Paengkoum 2022).

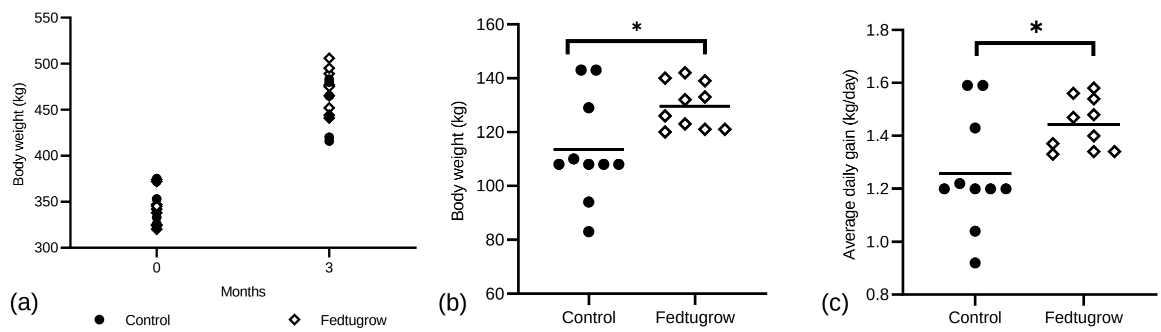

Figure 1 (a) Body weight before and at the end of the fattening period, (b) body weight gain during the fattening process, and (c) daily body weight gain during the fattening process in cows consuming Fedtugrow® Symbol* showed a significant difference at the 5% level (p<0.05).

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Beef cattle have a high number of erythrocytes to compensate for their high metabolic rate, especially during the fattening phase (Richardson *et al*. 1996). Although there has been no report of a positive correlation between erythrocyte profile and bovine body weight growth, erythrocyte deficiency (anemia) can result in weight gain loss and death during prolonged severe anemia (Casanova *et al*. 2018). Cellular metabolism is greatly affected by erythrocytes because 98.5% of oxygen is bound by hemoglobin (Foote *et al*. 2016). Erythrocyte deficiency (anemia) can result in weight gain loss and death during prolonged severe anemia (Casanova *et al*. 2018).

White Blood Cell Profile (Leukocytes)

Fedtugrow® administration during the fattening period did not affect the number of leukocytes in the beef cattle (Figure 3a). Similar findings have also been reported with the addition of katuk leaf flour in buffalo (Roza *et al*. 2015) and rabbit feed (Akbar *et al*. 2013), as well as depolarized katuk in dairy cows (Tarigan *et al*. 2022). It shows that no polar or nonpolar compounds in katuk leaves interfere with the body's defense response. The leukocyte profile provides an overview of the body's defense system's ability to protect it from pathogenic infections. A decrease in leukocytes weakens the body's defense system, making it easier for pathogens to multiply. In contrast, an excessively high number of leukocytes overactivates the body's defense system, which can worsen the body's condition when infected with pathogens owing to an excessive inflammatory response.

The fattening process of tropical cattle is highly susceptible to heat stress (Carvajal *et al*. 2021). Prolonged heat stress can interfere with livestock productivity (growth, milk and meat production, and reproduction) and increase susceptibility to infectious and noninfectious diseases (Sejian *et al*. 2018). The average temperature, relative humidity, and Temperature-Humidity Index (THI) were 29.15 ± 2.33°C,

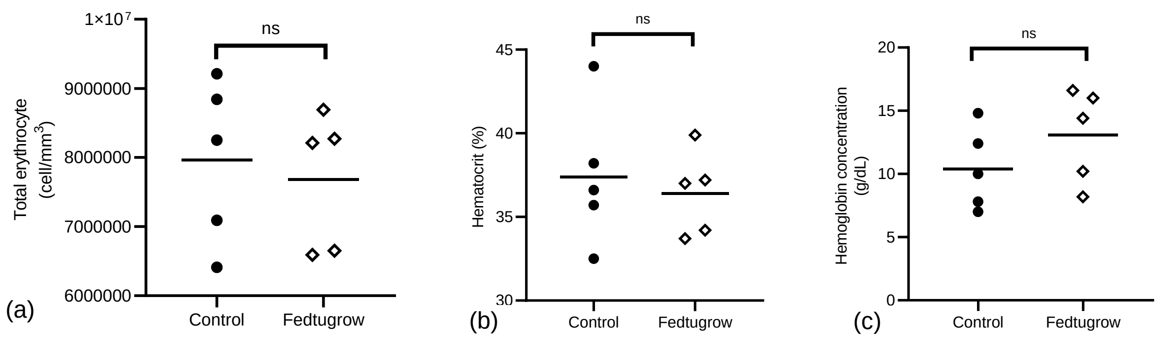

Figure 2 (a) Erythrocyte count (cells/mm³), (b) hematocrit (%), (c) hemoglobin level (g/dL) of beef cattle after consuming Fedtugrow® for three months during the fattening period. The ns symbol shows no significant difference at the 5% level (p<0.05).

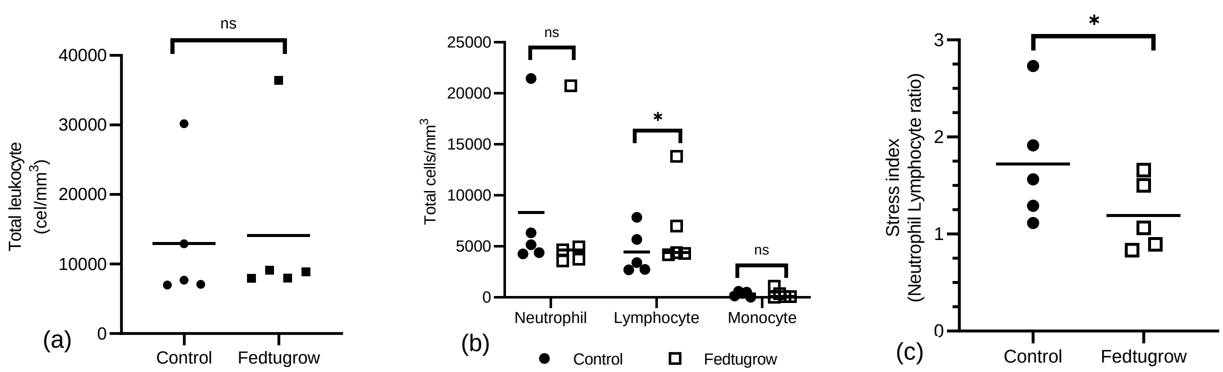

Figure 3 (a) Number of leukocytes (cells/mm³); (b) number of neutrophils, lymphocytes, and monocytes (cells/mm³); (c) stress index (neutrophil: lymphocyte ratio) of beef cattle after consuming Fedtugrow for 3 months during the fattening period. The symbol * indicates a significant difference at the 5% level (p<0.05), ns: insignificant.

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respectively; 86.15 ± 13.31%; and 82.17 ± 2.36, respectively, indicating a moderate environmental stress index.

Fedtugrow® administration significantly increased (P<0.05) the number of lymphocytes (Figure 3b); thus, it significantly (p<0.05) decreased the value of the stress index or neutrophil-to-lymphocyte ratio (Figure 3c) compared to the control that was not administered Fedtugrow®. The decrease in the stress index (neutrophil: lymphocyte ratio) is most likely related to the content of antioxidants, such as polyphenols and flavonoids, found in katuk leaves (Zhang *et al*. 2020). Antioxidants with polar and nonpolar fractions can prevent oxidative stress against various free radicals, such as 2,2-diphenyl-1-picrylhydrazyl (DPPH), superoxide, and nitric oxide (Purba and Paengkoum 2022). Stress is the body's response to stressors initiated by activating the hypothalamic-pituitary-adrenal gland-adrenal axis, followed by an increase in the secretion of glucocorticoid hormones from the adrenal glands. Glucocorticoid hormones (cortisol and corticosterone) affect innate and adaptive immunity by increasing the mobilization of neutrophils into the bloodstream and inhibiting lymphocyte migration into the bloodstream. As a result, there is an increase in the neutrophil-to-lymphocyte ratio, which is used as an indicator to assess the stress response that describes the amount of glucocorticoid hormones in the bloodstream (Davis *et al*. 2008).

CONCLUSION

Consumption of Fedtugrow® for 3 months during the fattening period can significantly increase daily body weight gain and decrease the stress index (neutrophil-to-lymphocyte ratio). In addition, hematological parameters (number of erythrocytes, hemoglobin levels, hematocrit, and number of leukocytes) were not affected by Fedtugrow®. They ensured the safety of Fedtugrow® as a concentrated feed that is efficacious for the health of beef cattle in smallholder farms.

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