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The Impact of Turmeric, Curcuma, and Ginger Feed Additives on the Productivity of Kaur Cattle as a Genetic Resource in Bengkulu

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ABSTRACT. Kaur cattle, a local breed in Bengkulu, represent a valuable genetic resource that requires preservation and effective utilization to enhance livestock production. Turmeric, curcuma, and ginger are plants known for their essential oils and curcumin content, which offer numerous proven benefits. This study aimed to evaluate the impact of these feed additives on the productivity of Kaur cattle. A quantitative research method employing a completely randomized design was used, consisting of four treatments and four replications. The diet comprised wild grass (10% of body weight) and palm kernel meal in an 80:20 ratio. The treatments were as follows: P0 (control: wild grass and palm kernel meal), P1 (wild grass, palm kernel meal, and turmeric powder *Curcuma xanthorrhiza* Roxb.), P2 (wild grass, palm kernel meal, and curcuma powder *Curcuma longa* L.), and P3 (wild grass, palm kernel meal, and ginger powder *Zingiber officinale* Rosc.). The study involved 16 male Kaur cattle aged 1.5-2 years, with an average body weight of 160-180 kg, observed over 60 days. The variables measured included average daily weight gain, forage consumption, total feed consumption, feed efficiency, and cost efficiency. Data were analyzed using a one-way ANOVA. The results showed that the mean daily weight gain (kg/head/day) was P0=0.35±2.57, P1=0.47±2.39, P2=0.50±2.46, and P3=0.49±2.88, with no significant differences between treatments. The mean feed efficiency (%) was P0=0.12±4.44, P1=0.25±4.71, P2=0.27±5.22, and P3=0.26±4.38, also showing no significant differences. The mean cost efficiency for feed use was P0=35,869±7.47, P1=34,281±7.08, P2=33,220±7.39, and P3=35,410±7.21, with no significant differences observed. Overall, the addition of turmeric, curcuma, and ginger powders to the feed did not significantly impact the productivity of Kaur cattle.

Keywords: feed additives, Kaur cattle, performance

INTRODUCTION

Ruminant livestock, particularly cattle, play a critical role in supporting the Indonesian economy. The demand for beef in Indonesia has been steadily increasing each year (Kementerian Pertanian RI, 2017; BPS RI, 2022). Currently, the cattle population in Indonesia is approximately 16.6 million, with 43% located on the island of Java, 25% in the Eastern Islands, and the remaining 32% distributed across other islands (Ali and Muwakhid, 2017). Data from the Indonesian government indicate that the demand for beef rose from 669,731 tons in 2021 to 706,388 tons in 2022. National beef production in 2022 was estimated at 436,704 metric tons, up from 423,443 metric tons in 2021. Despite this increase, Indonesia faced a beef deficit of 207,199 metric tons, after accounting for an initial stock of 62,485 metric tons. To address this shortfall, the government set a reserve stock of 58,886 metric tons, resulting in imports totaling 266,065 metric tons (Business Economics, 2022). One significant factor contributing to this shortfall is the rapid population growth in Indonesia (Khotimah, 2022), which creates substantial pressure on domestic beef production.

Indonesia is rich in traditional medicinal plants, which are used not only in human and veterinary medicine but also as supplements in animal feed (Haniarti *et al*., 2018; Manek, 2022). Rhizome plants, such as turmeric, curcuma, and ginger, are known for their content of essential oils, starch, and fiber, and they are extensively utilized in the Indonesian pharmaceutical industry (Rosidi *et al*., 2016; Aryanta, 2019; Azis, 2019).

Kaur cattle, similar to Bali and Sumbawa cattle, are a valuable genetic resource in Indonesian livestock (Kementerian Pertanian RI, 2022; Balai Pengkajian Teknologi Pertanian Bengkulu, 2022). These cattle are indigenous to Kaur Regency in Bengkulu Province, a region where 18.62% of the population lives in poverty, and 96.21% of families were beneficiaries of the Family Hope Program in 2021 (BPS Bengkulu, 2022). Many Kaur residents raise cattle, but due to limited knowledge and insight regarding cattle farming, especially in feed management, the community has yet to fully realize its potential. Livestock feeding practices are often limited to basic recirculation, and the frequency of feeding is inconsistent. This issue arises from a general lack of awareness about the benefits of traditional medicinal plants in animal feeding and other alternative supplementary feeding options.

Feed is a crucial factor in livestock production, as it serves as the primary energy source necessary for sustaining life and promoting growth. Feed costs represent approximately 70% of

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the total cost of livestock production (Nuningtyas, 2014; Astuti *et al*., 2015). The inclusion of 200 ml of curcuma domestica (*Curcuma domestica* Val.) and 200 ml of curcuma xanthorrhiza (*Curcuma xanthorrhiza* Roxb.) in commercial feed has been shown to improve cattle weight gain, increase feed consumption, enhance feed efficiency, and reduce feed cost per unit of weight gain (Khurun'in *et al*., 2023). Turmeric, curcuma, and ginger are alternative feed additives that can potentially stimulate livestock growth due to their high antioxidant content, health benefits, and immune-boosting properties. These plants are also rich in essential oils, which help detoxify harmful chemicals in livestock (Rahmat *et al*., 2021; Asghar *et al*., 2023; Jawawi *et al*., 2023).

Based on these considerations, this study was conducted to evaluate the effects of adding turmeric, curcuma, and ginger as feed additives on the performance of Kaur cattle.

MATERIALS AND METHODS

Materials

The equipment used in this study included a feed scale with a capacity of 20 kg and an accuracy of 50 g, a livestock scale with a capacity of 500 kg, feed and drink containers, and cage cleaning equipment. The materials utilized comprised cow organic forage feed and powders made from turmeric, curcuma, and ginger.

Experimental Design

The research employed a quantitative method with a completely randomized design, featuring 4 treatments and 4 repetitions. This design was selected for its ability to minimize bias in the grouping of test animals, ensuring that each animal received random and independent treatment. The weight of the cows ranged from 160 to 180 kg, with a diversity coefficient of 7.9%, indicating uniformity in the observed data (Nasoetion, 1992). The ratio of wild grass (12.6 kg/day) to palm kernel meal was 80%:20%. The treatments were as follows: P0= ransom (control); P1= ransom + turmeric powder (1% of body weight); P2= ransom + curcuma powder (1% of body weight); and P3= ransom + ginger powder (1% of body weight). The study included 16 male Kaur cattle aged 1.5-2 years, with an average body weight of 160-180 kg, observed over 60 days. Data collection involved measuring feed consumption, daily body weight gain, and feed conversion.

Observational Variable

Feed consumption (kg/head/day) was calculated by subtracting the remaining feed from the amount provided. Daily body weight gain (kg/head/day) was determined by subtracting the initial body weight from the final body weight and dividing by the number of days in the study. The efficiency of ransom use was calculated as the ratio of body weight gain to the amount of feed consumed. Feed cost per gain (fc/g) was calculated based on the price of feed during the study, divided by the average weight gain achieved.

Data Analysis

The data were analyzed using one-way analysis of variance (ANOVA). If significant differences were found, Duncan's Multiple Range Test (DMRT) was applied for further analysis.

RESULTS AND DISCUSSION

Effect of Feed Additives on Body Weight Gain

Feeding livestock with appropriate intake yields significant benefits, as indicated by one key indicator: body weight gain. The results of the 60-day observation of Kaur cattle are presented in Table 1.

The results of the 60-day observation of Kaur cattle are presented in Table 1. The total body weight gain following feed treatment was as follows: P0= 1.39±3.16 kg/head/day, P1= 1.87±3.97 kg/head/day, P2= 1.99±3.52 kg/head/day, and P3= 1.94±3.69 kg/head/day. These results align with previous research by Tabun *et al*. (2022), which indicated that adding turmeric and curcuma to cattle feed increased body weight gain, though not significantly. The combination of seed and organic forage feed promoted faster body weight development compared to single feeds (Liu *et al*., 2015; Honig *et al*., 2022). The feed consisted of 10% of the bull's weight and 1.5% palm kernel meal, containing 20% BC, 13.5% ash, 10.1% protein, 1.6% fat, 30.6% fiber, 44.2% BETN, 56.1% TDN, and 0.53% calcium. Palm kernel meal provided 15.14% crude protein, 6.08% crude fat, 17.18% crude fiber, 0.47% calcium, 0.72% phosphorus, 57.80% BETN, and 5,088 kcal/kg of gross energy. Nutrient requirements for cattle included 2.42 kg (BK) and 50.78% (TDN). During the first month, the supply was 1.5 times the actual requirement, with a 0.5 times safety stock, ensuring adequate feed supply before the second month. High-energy, low-protein foods supported bone and muscle building in early growth stages, while higher protein feeds were

needed later for optimal muscle development (Keady *et al*., 2021; Kamiya *et al*., 2020; Gonzalez *et al*., 2018). Turmeric facilitated enzymatic metabolic processes due to its curcuminoid and essential oil content (Kuswandi *et al*., 2022). The maximum daily weight gain averages were P0= 0.35±2.57 kg/head/day, P1= 0.47±2.39 kg/head/day, P2= 0.5±2.46 kg/head/day, and P3= 0.49±2.88 kg/head/day. Statistical analysis showed no significant difference among the four treatments. Curcumin increased TDN content by enhancing digestive enzyme activity, improving nutrient availability (Canibe *et al*., 2022). Ginger's active compounds stimulated digestive enzymes, improving protein digestion and livestock growth (Mohammadi *et al*., 2020; Al-Khalaifah *et al*., 2022).

Table 1. Daily Body Weight Gain of Kaur Cattle (kg/head/day)

Treatment	Repetitions				Average	p-value
	1	2	3	4		
P0	0.15	0.49	0.75	0.25	0.35±2.57	0.071
P1	0.23	0.95	0.69	0.29	0.47±2.39	0.093
P2	0.27	0.96	0.76	0.31	0.50±2.46	0.112
P3	0.24	0.98	0.72	0.29	0.49±2.88	0.125

Effect of Feed Additives on Forage Consumption

Ruminant feed consumption is influenced by various factors, including feed, livestock, and environment. Table 2 shows data on the impact of feed additives on forage consumption. The average forage consumption values were P0 = 1.34 ± 2.56 kg/head/day, P1= 1.74±2.38 kg/head/day, P2= 2.01 ±3.27 kg/head/day, and P3= 2.04±3.62 kg/head/day. Statistical analysis revealed no significant difference (p>0.05) between the treatments. Although ginger extract supplementation increased daily dietary intake, the increase was not significant. Feed consumption was positively influenced by curcumin extract, with increased food intake observed compared to the control group (Recharla *et al*., 2021). Turmeric extract, rich in bioactive substances such as curcumin, stimulated livestock's digestive system, encouraging higher food consumption (Sureshbabu *et al*., 2023; Jiang *et al*., 2019). Ginger extract stimulated appetite and nutrient availability, improving cattle growth and health (Rafiqi *et al*., 2022; Al-Khalaifah *et al*., 2022). Proper feeding frequency positively impacted cattle weight gain (Heryanto *et al*., 2016).

Table 2. Forage Consumption (kg/head/day)

Treatment	Repetitions				Average	p-value
	1	2	3	4		
P0	0.58	0.62	0.69	0.88	0.69±2.56	0.094
P1	1.61	1.53	1.71	2.13	1.74±2.38	0.131
P2	1.86	1.82	1.98	2.39	2.01±3.27	0.137
P3	1.91	1.83	2.01	2.43	2.04±3.62	0.152

Effect of Feed Additives on Ransom Consumption

Ruminant livestock, such as cattle, have a high ability to digest fiber-rich ransom. The impact of feed additives on ransom consumption is shown in Table 3. The average ransom consumption values were P0= 4.47±3.91 kg/head/day, P1= 5.06 ±2.89 kg/head/day, P2= 5.21±2.83 kg/head/day, and P3= 5.33±3.13 kg/head/day. Statistical analysis indicated no significant difference (p>0.05) between the treatments. The addition of turmeric and curcuma increased ransom consumption in Kaur cattle. Curcumin and essential oils in curcuma accelerated gastric emptying and increased appetite (Nova *et al*., 2015). The total daily ransom consumption results were P0= 17.86±3.54 kg/head/day, P1= 20.23±3.17 kg/head/day, P2= 20.85±3.88 kg/head/day, and P3= 21.32±3.62 kg/head/day.

Curcuminoids' bitter and spicy taste and aromatic odor influenced ransom consumption in each treatment. A possible reason for decreased consumption is the curcumin-induced increase in bile and pancreatic secretion, enhancing digestion and rapidly fulfilling cattle's nutritional needs (Nova *et al*., 2015).

Table 3. Consumption of Ransom (kg/head/day)

Treatment	Repetitions				Average	p-value
	1	2	3	4		
P0	3.67	4.12	4.73	5.35	4.47±3.91	0.116
P1	4.88	4.51	5.11	5.74	5.06±2.89	0.223
P2	5.01	4.65	5.25	5.94	5.21±2.83	0.255
P3	5.13	4.77	5.38	6.03	5.33±3.13	0.291

Effect of Feed Additives on Ransom Efficiency

Ransom efficiency is influenced by factors such as body weight, age, production level, ransom composition, and nutritional value. Observational data on ransom efficiency are presented in Table 4. The average efficiency values were P0= 0.12± 4.44, P1= 0.25±4.71, P2= 0.27±5.22, and P3= 0.26 ±4.38. Statistical analysis showed no significant difference ($p>0.05$) between the treatments. The total efficiency values ranged from P0= 0.46±4.47 to P3= 1.03±4.47. Ransom efficiency is related to ransom consumption and daily weight gain (Ibrahim and Usman, 2019). In this study, feeding efficiency was not significantly different ($p>0.05$) due to the lack of significant differences in feed consumption and weight gain. The average efficiency of cattle feed in the study ranged from 0.1385±0.1687, which is higher than the 0.0752± 0.0129% reported by Siregar (2003), indicating better results. A low-efficiency value suggests less efficient food-to-meat conversion, while a higher efficiency value indicates that less ransom is required to produce body weight gain.

Table 4. The Efficiency of Ransom Consumption (%)

Treatment	Repetitions				Average	p-value
	1	2	3	4		
P0	0.08	0.10	0.14	0.15	0.12±4.44	0.085
P1	0.22	0.23	0.26	0.28	0.25±4.71	0.107
P2	0.23	0.25	0.29	0.31	0.27±5.22	0.111
P3	0.23	0.25	0.27	0.29	0.26±4.38	0.129

Effect of Feed Additives on Feed Cost Ratio Gain

The economic potential of the ransom used can be determined by measuring the feed cost per gain. Feed cost per gain refers to the cost of feed required for every 1 kg increase in the body weight of cattle. In other words, it represents the cost incurred for each kilogram of weight gained by the livestock. The feed cost per gain data in this study are presented in Table 5.

The lowest average feed cost was achieved by adding a feed additive in the form of curcuma powder, resulting in IDR 33,220 (P2). This low feed cost per gain is attributed to the higher body weight gain observed in this treatment. A lower feed cost per gain is considered economically favorable, indicating more efficient use of feed. The feed cost per gain can be further reduced by optimizing daily weight gain and lowering feed costs through the use of more efficient feed types. Optimizing daily weight gain can be achieved by implementing good maintenance management practices.

Table 5 also reveals that the highest feed cost per gain value was found in the P0 treatment ($p>0.05$). This may be due to the lower body weight gain observed in this group, as the Kaur cattle used were in the finisher period. The level of feed costs depends on several factors, including the price of feed, the efficiency of feeding according to the type of livestock, body weight, age, physiological status (such as growth, maturity, pregnancy, lactation, and dry period), and environmental conditions (Sodikin, 2016; Periambawe *et al*., 2016).

Table 5. Cost of Efficient Use of Ransoms (IDR)

Treatment	Repetitions				Average	p-value
	1	2	3	4		
P0	16.801	30.912	37.854	57.910	35.869±7.47	0.085
P1	12.153	29.944	38.154	56.873	34.281±7.08	0.071
P2	13.879	23.175	37.678	58.148	33.220±7.39	0.068
P3	14.108	27.161	41.283	59.087	35.410±7.21	0.079

Based on the data in Table 5, the total value of the average gain at the feed cost ratio was P0= 35.869±7.47; P1= 34.281±7.08; P2= 33.220±7.39; and P3= 35.410±7.21. The results of the statistical analysis showed no significant difference ($p > 0.05$) between the four treatments. During the study, the price of field grass was IDR 1,700/kg. The results of the descriptive analysis indicate that the feed cost per gain was similar across all treatments, reflecting consistent cost efficiency regardless of the feed additives used.

CONCLUSIONS

The inclusion of additives such as turmeric powder, curcuma powder, and ginger powder in cattle feed showed positive effects on daily body weight gain, feed consumption, and feed cost efficiency. However, the statistical analysis revealed that the differences in the tested parameters were not significant. Despite the lack of significant differences, these feed additives demonstrated potential benefits in cattle production.

CONFLICT OF INTEREST

There is no conflict of interest in this research, whether financial, personal, or involving any organization related to the material presented in this study.

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