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Effect of Protected Calcium Salts of Fatty Acid-Amino Acid on Growth Rate of Young Ongole Crossbred Bulls

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ABSTRACT

Background: Protected calcium salts-fatty acid-amino acid supplement contains high-density of energy that can be used as cattle feed. This study aimed to test the efficacy of the supplements in the growth rate of young Ongole crossbred bulls.

Methods: Thirty Ongole crossbred bulls (345±14 kg; live weight±SEm) were ranked and blocked based on liveweight and randomly allotted to one of three supplement levels (A: null 0 g/kg; B: 0.3 g/kg and C: 0.6 g/kg LWs) and 10 replicates. All bulls were offered elephant grass and a concentrate diet containing 12% crude protein and 65% of total digestible nutrients. The parameters were liveweight gain, hip height gain, body condition score, feed conversion ratio, plasma fat and glucose concentrations, back fat and muscle depth.

Result: There was no significant difference in feed intake among treatment groups (P>0.05). All bulls ate around 11 kg/d on a DM basis, equal to around 2.8% LW. Bulls in C group were heavier and gained more weight (P<0.05) and required less feed/kg LWG. The depths of backfat and muscle depth were no differences between treatments (P>0.05). The inclusion of 0.6 g/kg LW of the supplement improve the growth rate of young Ongole crossbred bulls.

Key words: Amino acid, Bull, Calcium salts, Growth rate, Ongole.

INTRODUCTION

The common feeds used in tropical countries are usually from agricultural byproducts, with low nutritive quality characterized by low digestible nutrients, crude protein, soluble sugar and starch contents, while having high biomass and fiber content (Leng, 1990). The seasonal changes are also an issue in providing feed. In the dry season, the grass grows very poorly, resulting in low productive performance of ruminants (Fernandes *et al.* 2020). Providing supplements is an option to improve the nutritional content for cattle fed on low-quality crop residues. Studies reported that concentrate diet supplementation improved productive performance of cattle. Heifers supplemented with concentrate diet increased the liveweight gain (Carvalho *et al.* 2017) and the supplement also maintained the cow performance (Mediksa *et al.* 2021; Gekara *et al.* 2001). Despite the positive effect of concentrate diet supplementation, it is costly for most farmers in Indonesia.

Palm fatty acid distillate (PFAD) containing high densed energy (fat), accounting for 82% (Indarto *et al.* 2020) and it can be used as an energy supplement (Wina and Susana, 2013). However, high content of fat in the feed can be harmful for rumen microorganisms, therefore the fat should be protected. The calcium salts of fatty acid are protected lipid that is made from PFAD as the main ingredient that is a by-product of the crude palm oil refinery. The supplement is made through a process of saponification in a heating process (Strohmaier *et al.* 2003). The calcium salts of fatty acid are commonly included in the dairy cow's diet, as it improves the milk yield and quality (Mane *et al.* 2017), the performance of the offspring's as well as energy partitioned to body reserves of the cows (Marques *et al.* 2017; de Souza and Lock, 2018). A high-energy diet is expected to improve the nutritional content of crop residues and improves cattle productivity.

The information about the use of that supplement in beef cattle feed is scarce. Therefore, the current experiment aimed to test the efficacy of the supplement in the productive performance of young Ongole crossbred cattle.

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MATERIALS AND METHODS

The following study was conducted under the guidelines of the Indonesian Code of Practice for the Care and Use of Animals for Scientific Purposes and was approved by the Indonesian Ministry of Agriculture Animal Ethics Committee (Balitbangtan/Lolitsapi/Rm/08/2020).

The experiment was conducted in the Indonesian Beef Cattle Research Station (BCRS) at Grati, East Java, Indonesia from early November 2020 to mid of May 2021. It consisted of a 14-day pre-experimental period followed by a 190-day experimental period. Before the start of the experiment, 30 young Ongole crossbred bulls of approximately 350±14 kg (LW±sem), ±2 years old were selected from the herd of the population in BCRS and were weighed and measured (LW and BCS), treated with anthelmintic. The bulls then were ranked and blocked on LW and housed in individual pens with one bull in each pen. Within each block, bulls were randomly allocated to each of the supplement treatments (Table 1). The experimental design was a randomized complete block design with three different supplement treatments and ten replicates.

All bulls were fed twice a day, at 07:00AM and 13:00AM with elephant grass (EG) *Pennisetum purpureum* containing 893 gOM, 800 gCP, 712 gNDF/kg DM and commercial concentrate (CONS containing 12% of crude protein, 5.3% of crude fat, 20% of crude fiber and 9% of ash), the feed was given at 4% LW on a DM basis, with the ratio of EG: CONS diet was 20:80.

The supplement was prepared by reaction of palm fatty acid distillate (PFAS) and calcium and lysine monohydro chloride was added and mixed thoroughly, the yellowish granules were then formed. The supplement was then dried at 60°C and grounded.

Measurements

The feed intake was measured daily by subtracting the amount of feed refused from the weight of feed offered. Sub-samples of feed offered and refused were collected each day, bulked for a week mixed thoroughly and duplicate sub-samples were collected for proximate analysis (DM, CP, organic matter (OM), crude fiber (CF) and total digestible nutrient (TDN) (AOAC, 2005).

Liveweight (LW) was measured early in the morning before feeding fortnightly. The body condition score (BCS) was assessed by the same person at the same time as weighing at the start and the end of the experiment, using a 1-5 scale. The blood samples were collected at the end of the experiment for analyses of plasma metabolites, plasma fat (triglyceride, LHL, HDL cholesterols) and glucose concentrations.

The fatdepth was measured at the end of the study. The parameters were backfat thickness (BF), longissimus dorsi thickness (LD), rump fat thickness (RF) and rump thickness (RT). Carcass quality characteristics were estimated using an ultrasound linear transducer at frequency 4.5 to 6.5 MHz and a depth of 11 cm. Application of ultrasound on BF and LD MS and PIF followed Ulum *et al.* (2014), while the measurement of the thickness of rump and rump fat according to Silva *et al.* (2012) performed between *tuber coxae* and *tuber ischii.*

Statistical analysis

The SPSS software program (SPSS Statistic, IBM, New York) version 23 with the General Linear Model was used to analyse animal measurement data. The data presented in the bar chart were least-square means. The 5% level significance was used to consider the difference between means.

RESULTS AND DISCUSSION

Intakes, liveweight gain, hip height gain and body condition score

Feed intake, liveweight gain, body confirmation and body condition score data are presented in Table 2. There was no significant difference in feed intake among treatment groups (P>0.05; Table 2). All bulls ate around 11 kg/d on a DM basis, equal to around 2.8% LW. Our results were above the maintenance level, 2.3% LW (Syahniar *et al.* 2012). The results demonstrated that the production could be improved in cattle fed concentrate diet and elephant grass, although the supplement did not affect the DM intake across all the treatment groups as they were offered the same cons: EG ratio.

At the start, the liveweight of bulls was not different between treatments (P>0.05). Bulls offered supplement at 0.6 g/kg LW were heavier and gained more LWG (P<0.05;

Table 1: Experimental design.

Treatments	Number of bulls	Feeding
A	10	Elephant grass + Concentrate diet (Control)
B	10	Control + supplement at 0.3 g/kg liveweight
C	10	Control + supplement at 0.6 g/kg liveweight

Table 2: Dry matter intake, liveweight gain, body condition score and the feed conversion ratio of Ongole crossbred bulls offered protected calcium salts of fatty acid-amino acid at *nill* (A), 0.3 g/kg LW (B) and 0.6 g/kg LW (C).

Parameter	A	B	C	P
Dry matter intake (kg/day)	11.4	11.9	11.7	0.71
Liveweight gain (kg/d)	0.64^{b}	0.78^{ab}	0.84^{a}	0.04
Final liveweight	480.4^{b}	499.5^{a}	503.4^{a}	0.03
Body condition score*	3	3	3	0.71
Hip height gain (mm/100 day)	56.0	69.2	77.5	0.19
Feed conversion ratio (kg DM/kg LWG)	17.7	15.9	14.8	0.38

*at the end of the study.

Table 2). The inclusion of 0.3 g/kg LW of supplement in the diet only improved slightly higher LWG, it indicated that the dose of the supplement that should be provided in the diet was 0.6 g/kg LW. Our result was in line with He *et al.* (2018) who reported that the supplement increased LWG but did not affect DM intake. Studies showed varied results, the supplement increased the DM intake (da Cruz *et al.* 2019) while others showed a decreasing trend in DM intake (Fiorentini *et al.* 2014; de Souza *et al.* 2017). Those varieties of responses depend very much on the basal diet offered to the cattle and the level of which supplement was provided in the diet.

At the end, the BCS was not different between treatments. All groups reached BCS 3, indicating they were all in good condition. The BCS change of those groups was 0.12; 0.08 and 0.13. Our results were in agreement with de Souza *et al.* (2017) who showed that the BCS was not affected by the supplement treatments. The BCS of cattle indicates a good index of subcutaneous fat, such as rump fat thickness although the LW showed a low correlation with both BCS and rump fat thickness (Ayres *et al.* 2009; Paul *et al.*, 2020).

The hip height gain was not different between treatments (P=0.19; Table 2). The HH gain was slightly lower than that was reported by Antari, (2018) in Brahman-cross steers at the same age (85 mm/100 d). Our results showed that the bulls still grew taller but at a slower rate than the previous study, the differences were probably because of the nutritional content of the diet offered to the cattle and the breed.

The supplement included in the diet was related to an increase in FCR, although it was not a significant difference (P>0.05) between each level of supplement. At the highest level of supplement, the bulls required less feed/kg LWG. Our results were within the range reported in the previous studies in Ongole crossbred bulls offered cassava tuber and *Gliricidia sp*., the FCR was 18 kg feed DM/kg LWG (Marsetyo *et al.* 2021) and in Ongole crossbred bulls fed elephant grass *adlibitum,* the FCR was 24 kg feed DM/kg LWG (Antari *et al.* 2016).

Plasma glucose and fats

The results showed that glucose, total cholesterol, triglyceride, LDL and HDL did not differ significantly (P>0.05; Table 3). Our results were in contrast to a study in Holstein's calves fed the same supplement showed significant increasees in triglyceride, cholesterol and LDL concentrations and no supplement effect on glucose concentration was detected (Ngu *et al*., 2020). The variety of the results is probably because of the basal diet and the physiological status of the cattle differences.

The fat depth and muscle depth

The depths of backfat and muscle depth were presented in Table 4. There were no differences between treatments in all muscle depth affected by the supplement treatments (P>0.05; Table 4). The muscle depths in our study were larger than those in Bali cattle, around 53.9 mm at the same age at position 12-13th (Jakaria *et al.* 2017), but lower than

Tabel 3. Plasma glucose, triglyceride, low-density lipoprotein (LDL), high-density lipoprotein (HDL) of Ongole crossbred bulls offered supplements containing protected calcium salts of fatty acid-amino acid at *null* (A), 0.3 g/kg LW (B) and 0.6 g/kg LW.

Parameters	Stage	A	B	C	P
Glucose (mg/dL)	Start	29.4	29.9	30.3	0.50
	End	28.0	26.5	30.8	0.35
Total cholesterol (mg/dL)	Start	155.6	157.3	164.7	0.90
	End	241.6	214.1	262.5	0.45
Triglyceride (mg/dL)	Start	19.5	16.6	18.4	0.36
	End	19.8	16.2	17.5	0.37
LDL (mg/dL)	Start	29.4	29.9	30.3	0.99
	End	28	26,5	30,8	0.75
HDL (mg/dL)	Start	86.3	84.4	97.1	0.48
	End	130.4	122.7	132.3	0.85

Tabel 4: The fat depth and muscle depth at P8, 12th - 13th and rump of Ongole crossbred bulls offered supplements containing protected calcium salts of fatty acid-amino acid at *null* (A), 0.3 g/kg LW (B) and 0.6 g/kg LW.

Areas	Treatments			sem	P
	A	B	C		
Muscle depth					
P8 (mm)	67.5	71.2	68.6	0.46	0.71
12th and 13th ribs (mm)	60.9	61.6	64.1	0.49	0.79
Rump (mm)	67.3	70.3	74.1	0.53	0.45
Fat depth					
P8 (mm)	6.0	4.7	5.5	0.07	0.16
12th and 13th ribs (mm)	4.7^{b}	5.0^{ab}	5.9^{a}	0.06	0.05
Rump (mm)	5.2	5.4	5.3	0.09	0.98

in Brahman cross steers (Antari, 2018), the eye muscle areas was around 68 cm^2, the discrepancy of the results probably because of breed differences and feed type offered to the cattle. Thus, the depth of the muscle was likely affected by the basal diet offered to the bulls. The growth rate is affected largely by feed types, intake and chemical composition of the feed. Accordingly, to achieve a fast growth rate, cattle required a high energy and protein intake (Antari, 2018). Our bulls were relatively young so that the growth and development still occurred. Although the depth of all muscle areas was not different, the bulls fed supplement diet tended to have a larger muscle than their cohorts.

The fat depth in P8 and rump areas was not affected by the supplement treatment but it affected the depth of the fat in positions 12-13th (P=0.05; Table 4). Our results indicated that the fat diet offered to the bulls affected the fat deposition in the 12-13th area, the value was larger than those in Ongole crossbred (3.56 mm) and Simmental x Ongole (4.32 mm) (Ngadiyono *et al.* 2014). Moreover, Himia *et al.* (2021) reported that fat deposition occurred when the muscle growth reached a maximum rate at around the mature weight, after that muscle growth declined and fat deposition started to increase. Meanwhile, the mature weight of cattle occurred at different ages. For example, Freetly *et al.* (2011) reported that there was a variety of mature age and weight in beef cattle, the mature age and weight of Brahman cross was 58 weeks and 343 kg, while Antari (2018) reported that mature age and weight of Brahman cross steers fed high energy and protein diet was 64 weeks and 850 kg. Thus, the fat depth might be vary depending on age, feed and whether the animals were castrated or not.

CONCLUSION

To conclude, 0.6 g/kg live weight of calcium salts of fatty acid-amino acid supplementation improve the growth rate of young Ongole crossbred bulls.

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Conflict of interest: None.

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