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An Evaluation on Growth Performance and Carcass Characteristics of Integration (Oil Palm Plantation) and Feedlot Finished Bali Cattle

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Abstract: The objective of this study was to evaluate the differences in growth performance and carcass characteristics of Bali cattle subjected to oil palm integration and two different feedlot finishing systems (basal vs. high energy). Eighteen, 24-30 months old male Bali cattle were involved in this study. The animals were randomly allotted into 3 feeding groups: Integration (INT), (n = 6 animals), Feedlot A (FA) with basal energy (n = 6 animals) and Feedlot B (FB) with high energy (n = 6 animals). The animals assigned to the integration system were allowed to graze on the native forages and legumes available under the oil palm plantation. The basal energy diet consisted of 5 kg Palm Kernel Cake (PKC) pellets + *ad libitum* corn stover and the high energy diet which consisted of 5 kg Palm Kernel Cake (PKC) pellets + *ad libitum* corn stover + 400 g calcium soap of palm oil fatty acids (Megalac®, Volac International Limited, UK) were fed to the animals in FA and FB, respectively. The feeding trial was conducted for 120 consecutive days excluding 3 weeks of adaptation period. The present data suggest that some of the growth parameters and carcass traits in Bali cattle can be enhanced through the feedlot finishing system.

Key words: Bali cattle, integration, feedlot, growth, carcass, fatty acid

INTRODUCTION

Bali cattle (*Bos sondaicus*, *Bos javanicus* and *Bos/Bibos banteng*) could be a domesticated descendant of the wild Banteng (*B. banteng*). They have been classified as indigenous in Indonesia and currently are also found in Malaysia, the Philippines, Hawaii and Northern Territory of Australia. In comparison with other indigenous cattle breeds, Bali cattle are known of their advantages in growth and reproductive performances albeit under poor nutritional status (Andrews, 1972; Copland, 1974). Being reared for draught and meat production, Bali cattle have been considered as superior meat animals based on their reasonably high dressing percentage (Payne and Rollinson, 1973). Earlier research by Suwindra (1972) reported carcass dressing percentages in mature females bulls and steers as 55.8, 56.6 and 56.5%, respectively. In relation to that Mastika (2002) suggested that the growth, feed conversion efficiency and meat quality of Bali cattle could be enhanced through improvements in feeding quality and management. Feeding quality and management are crucial during cattle finishing phase to allow well-grown animals to maximize meat yields and optimize fat cover. This will improve animal performance and productivity through shortening of fattening period for slaughter.

Integrated cattle rearing in oil palm plantation has been introduced in Malaysia to increase the beef production. In Malaysia, the livestock-crop integration system is currently headed by PINTAR, the Malay acronym for Ruminant/Tree Crop Integration Project which was initiated by the Department of Veterinary Services, Malaysia in 1987 under its Targeted Area Concentration (TAC) program (Chin, 1998). Currently in

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Malaysia there are approximately 300 Bali cattle reared under oil palm estate of FELDA (Federal Land and Development Authority) Farm Products Pty. Ltd. The integration system has not only increased the intensity of agricultural land utilization but also had reduced the cost of beef cattle and oil palm productions (Latif and Mamat, 2002). On the other hand, feedlot fattening of ruminants is the intensive fattening or finishing of ruminants from land based pastoral or mixed farming systems. Different levels of dietary energy and protein influence the growth rate and carcass characteristics of ruminants (Solomon *et al*., 1986; McDonald *et al*., 1991). Studies conducted by Mastika (2002) and Tahuk and Dethan (2010) have documented improved body weight and carcass characteristics of Bali cattle subjected to feedlot system with good quality concentrate-supplemented diets.

However, to the best of the knowledge, comparative data on their growth performance and carcass characteristics between semi-intensive and intensive feeding systems as well as between different energy levels of diets are still unavailable. Thus, this study was carried out to evaluate the differences in growth performance and carcass characteristics of Bali cattle subjected to oil palm integration and two different feedlot finishing systems (basal vs. high energy).

MATERIALS AND METHODS

Animal feeding and growth monitoring: Eighteen, 24-30 months old Bali bulls were used in this experiment. The animals were randomly selected from an existing herd located in an oil palm plantation in Tembangau 6, FELDA Farm Products Pty. Ltd., Malaysia based on the stocking rate of 4.6 ha per animal. They were randomly assigned to 3 finishing groups: Integration (INT), (n = 6 animals), Feedlot A (FA) with basal energy (n = 6 animals) and Feedlot B (FB) with high energy (n = 6 animals). The animals assigned to the INT group were allowed to continue grazing on the native forages and legumes available under the oil palm plantation with the age of oil palm trees approximately 5 years. Basal energy diet consisted of 5 kg Palm Kernel Cake (PKC) pellets + *ad libitum* corn stover and high energy diet consisted of 5 kg Palm Kernel Cake (PKC) pellets + *ad libitum* corn stover + 400 g calcium soap of palm oil fatty acids (Megalac®, Volac International Limited, UK) were fed to the animals in FA and FB, respectively. The nutrient composition of PKC pellets and calcium soap of palm oil fatty acids are as shown in Table 1. *Ad libitum* amount of drinking water and mineral blocks (Rockies, Tithebarn Ltd. UK) were offered to all groups of animals throughout the experiment. The animals were acclimatized for 3 weeks before the actual feeding trial started of which once completed their initial and final body weights were taken for the determination of growth performance. The entire feeding trial for all groups lasted for 120 days.

Table 1: Nutrient composition of PKC pellets and calcium soap of palm fatty acids (Megalac®)

Nutrient composition	PKC pellet	Megalac®
Moisture (%)	8.500	5.000
Crude protein (DM %)	16.00	-
Crude oil (DM %)	5.500	84.00
Ash (DM %)	2.600	12.50
Calcium (DM %)	0.820	9.000
Crude fibre (DM %)	22.00	-
Metabolizable energy (MJ kg^{-1} DM)	18.00	33.25

DM = Dry Matter

Slaughtering and carcass measurement: At the end of the trial, all animals were subjected to overnight lairage before humanely slaughtered according to the procedures outlined in the MS1500:2009. Empty live weight was recorded, prior to exsanguination while the hot carcass weight was measured after removal of skin and evisceration for the determination of carcass dressing percentage. Subsequently, carcass length and circumference were measured as outlined by De Boer *et al.* (1974) before chill storage. Following to that each carcass was longitudinally and symmetrically halved. Each half carcass was physically dissected and separated to lean, bone and fat tissues with the weight of each tissue recorded for the carcass physical composition (Morris *et al*., 2006).

Data analysis: The effects of the three different finishing systems on growth performance and carcass characteristics were analyzed by one-way Analysis of Variance (ANOVA) using Procedure of General Linear Model (PROC GLM) of SAS (2003) (Version 9.1, SAS Institute Inc., Cary, NC, USA). All data were compared across treatment groups using Duncan's Multiple Range test. The data were statistically tested at 95% confidence level and presented as means±SEM.

RESULTS AND DISCUSSION

The results of growth performance, carcass weight and dressing percentage of INT, FA and FB groups are as shown in Table 2. In this study, the animals from FA and FB group have indicated higher weight gain ($p<0.05$) than those in INT group. Body weight loss of 28.88±6.89 kg was noted in INT group at the end of the feeding trial. Moreover, the animals assigned to INT group have also indicated lower empty live weight and hot carcass weight ($p<0.05$) compared to those from the FB group. Although,

Table 2: Growth performance, carcass weight and dressing percentage of Bali cattle subjected to different finishing systems

	Finishing systems		
Parameters	INT	FA	FB
Initial weight (kg)^{NS}	304.83±9.33	256.00±17.30	252.83±22.63
Final weight (kg)^{NS}	283.50±9.24	327.83±21.32	343.17±24.95
Weight gain (kg)	-21.33±6.53^{b}	71.83±6.020^{a}	90.33±10.53^{a}
Empty live weight (kg)	260.67±6.24^{b}	308.67±22.10^{ab}	323.83±24.57^{a}
Hot carcass weight (kg)	148.64±5.17^{b}	179.58±14.49^{ab}	192.16±17.43^{a}
Dressing percentage^{NS}	57.17±2.43	58.02±0.800	59.02±1.080

Mean±SE; NS: Not Significant, means with different superscripts within a row differ significantly at $p<0.05$; INT: Integration system, graze on the native forages and legumes available under the oil palm plantation; FA: Feedlot system, 5 kg PKC pellets + *ad libitum* corn stover; FB: Feedlot system, 5 kg PKC pellets + *ad libitum* corn stover + 400 g calcium soap of palm oil fatty acids (Megalac®, Volac International Limited, UK)

Table 3: Carcass characteristics and composition of Bali cattle subjected to different finishing systems

	Finishing systems		
Characteristics	INT	FA	FB
Carcass length (cm)^{NS}	22.12±0.52	21.02±0.32	21.57±0.30
Circumference at 13th rib (cm)	11.70±0.31^{b}	13.48±0.34^{a}	13.22±0.57^{a}
Circumference at sternum (cm)^{NS}	15.08±0.24	15.82±0.40	16.20±0.59
Lean (%)^{NS}	68.65±1.58	72.05±1.98	68.19±1.96
Fat (%)	7.79±0.45^{b}	15.39±1.69^{a}	16.67±1.82^{a}
Bone (%)	23.56±1.47^{a}	12.56±1.45^{b}	15.14±1.04^{b}

Mean±SE; NS: Not Significant, means with different superscripts within a row differ significantly at $p<0.05$; INT: Integration system, graze on the native forages and legumes available under the oil palm plantation; FA: Feedlot system, 5 kg PKC pellets + *ad libitum* corn stover; FB: Feedlot system, 5 kg PKC pellets + *ad libitum* corn stover + 400 g calcium soap of palm oil fatty acids (Megalac®, Volac International Limited, UK)

not significant, the empty live weight and hot carcass weight shown by FA group was numerically higher than those in INT group. The initial weight final weight and dressing percentage were found to be similar among the 3 groups of animals. In general, despite being not significant, the final weight and dressing percentage of both FA and FB group animals were numerically higher than INT group (Table 2). In this study, higher energy diets were given to the animals in FA and FB group. In contrast, the animals in INT group offered only native grasses and legumes available under the oil palm plantation.

The influence of feeding management as well as feeding level on growth and meat yield has been documented earlier by Bidner *et al.* (1981, 1986) and Keane and Allen (1998). In Bali cattle, the present results are in agreement with Mastika (2002) who also reported higher body weight gain of animals fed higher quality concentrates. Meanwhile, the weight loss observed in INT group can be explained by poor grazing conditions resulted from heavy rain consistently encountered throughout the conduct of the experiment.

The differences in carcass characteristics and composition among the 3 finishing groups are as shown in Table 3. In this study carcass circumference measured at the 13th rib region and percentages of fat and bone were found to be affected ($p<0.05$) by the dietary treatments. The carcasses produced from both FA and FB groups indicated greater circumference with higher fat and lower bone percentages. Earlier study in goats documented positive correlations ($R^2 = 0.83$) between body weight and carcass circumference (Mourad *et al.*, 2001) which can be supported by the present findings whereby, the animals in FA and FB groups gained weight and indicated greater carcass circumference compared to their counterparts in INT group.

Besides, earlier studies have also reported lower fat content in carcasses of cattle finished on pasture (Bidner *et al.*, 1981, 1986; Williams *et al.*, 1983; Steen *et al.*, 2003). Nevertheless, the other parameters measured such as carcass length, circumference at sternum and percentage of lean remain unaffected ($p>0.05$) by the finishing systems employed in this study.

CONCLUSION

The present preliminary findings highlight the effect of feeding system on some of the growth performance parameters and carcass characteristics of Bali cattle in Malaysia. Improved growth performance and carcass characteristics were shown by the animals finished in the feedlot system. Hence, the present findings would at least provide a scientific basis for the existing cattle-oil palm integration farmers to consider finishing their animals in feedlot system as a mean of strategic feeding management in Bali cattle production. However, more extensive studies on economic aspect, meat quality traits and enhancement of the dietary composition through utilization of some available agricultural by-products should also be carried out in the future.

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