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SUPPLEMENTATION OF PROTECTED ENERGY IN GROWTH PERFORMANCE AND CARCASS QUALITY INBALI CATTLE (BOSJAVANICUSD'ALTON)

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SUPPLEMENTATION OF PROTECTED ENERGY IN GROWTH PERFORMANCE AND CARCASS QUALITY IN BALI CATTLE (*BOS JAVANICUS* D'ALTON)

By

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SUPPLEMENTATION OF PROTECTED ENERGY IN GROWTH PERFORMANCE AND CARCASS QUALITY IN BALI CATTLE (*BOS JAVANICUS* D'ALTON)

By

LEO TEIK KEE

February, 2014

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Bali cattle (*Bos javanicus* d'Alton) which are reared for meat production have been considered as superior meat animals with their reasonably high dressing percentage. In this study, a 120 days feeding trial was conducted to examine the effects of calcium soap of fatty acids as protected energy supplementation on growth performance, carcass characteristics, rumen fermentation and meat fatty acid composition of Bali cattle subjected to feedlot system. Twelve male Bali cattle of 24 to 30 months old were randomly selected and assigned to 2 groups of 6 animals in each and fed with basal and protected energy supplemented diets. The basal diet consisted of 43.75 % (of dry matter, DM) palm kernel cake (PKC) pellets + 56.25 % (of DM) corn stover, while the protected energy supplemented diet consisted of 40.62 % (of DM) PKC pellets + 3.13 % (of DM) calcium soap of palm oil fatty acids + 56.25 % (of DM) corn stover. The animals subjected to protected energy supplemented diet yielded significantly (p<0.05) higher final weight (343.17 ± 24.95 kg), empty live weight (323.83 ± 24.57 kg), hot carcass weight (192.16 ± 17.43 kg) and dressing percentage (59.02 ± 1.08 %) than those subjected to the basal diet. There were no significant differences (p>0.05) in carcass length, carcass circumference and carcass compactness measured between the dietary groups. In addition, carcass composition, rumen fermentation and fatty acid composition of skeletal muscles (*supraspinatus*, *longissimus dorsi* and *semimembranosus*) did not differ (p>0.05) between the two dietary groups. In conclusion, the inclusion of calcium soap of palm oil fatty acids as protected energy supplement in the finishing diet had improved growth performance and carcass quality of Bali cattle without affecting the rumen fermentation and fatty acid composition of skeletal muscles when subjected to

feedlot system.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Sarjana Sains

KESAN SUPPLEMEN TENAGA TERLINDUNG KE ATAS PRESTASI TUMBESARAN DAN KUALITI KARKAS LEMBU BALI (*BOS JAVANICUS* D'ALTON)

Oleh

LEO TEIK KEE

Februari, 2014

Pengerusi: Awis Qurni Sazili, PhD
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Lembu Bali (*Bos javanicus* d'Alton) yang diternak untuk pengeluaran daging telah dianggap sebagai lembu pedaging yang unggul disebabkan peratus lapah yang tinggi. Dalam kajian ini, kajian pemakanan selama 120 hari telah dijalankan untuk menilai keberkesanan garam kalsium dari asid lemak sawit sebagai supplemen tenaga terlindung ke atas prestasi tumbesaran, ciri karkas, fermentasi rumen dan komposisi asid lemak di dalam daging lembu Bali yang diternak dalam sistem fidlot. Dua belas ekor lembu Bali jantan yang berumur dalam lingkungan 24 - 30 bulan telah dipilih dan diasingkan secara rawak kepada dua kumpulan, dengan 6 haiwan dalam setiap kumpulan dan diberikan diet asas dan diet supplemen tenaga terlindung. Diet asas terdiri daripada 43.75% (bahan kering) pelet isirong kelapa sawit (PKC) + 56.25% (bahan kering) batang jagung manakala diet supplemen tenaga terlindung terdiri daripada 40.62% (bahan kering) pelet PKC + 3.13% (bahan kering) garam kalsium dari asid lemak sawit + 56.25 % (bahan kering) batang jagung. Hasil kajian ini telah menunjukkan haiwan yang diberi diet supplemen tenaga terlindung mengandungi berat badan akhir (343.17 ± 24.95 kg), berat hidup kosong (323.83 ± 24.57 kg), berat karkas panas (192.16 ± 17.43 kg) dan peratus lapah (59.02 ± 1.08 %) yang lebih tinggi (p<0.05) daripada haiwan yang diberi diet asas. Namun, tidak terdapat perbezaan tererti (p>0.05) pada panjang karkas, ukur lilit karkas dan kepadatan karkas di antara kumpulan haiwan tersebut. Tambahan pula, komposisi karkas, fermentasi rumen dan komposisi asid lemak otot (*supraspinatus*, *longissimus dorsi* and *semimembranosus*) adalah tidak berbeza (p>0.05) di antara kumpulan haiwan tersebut. Kesimpulannya, penambahan garam kalsium dari asid lemak sawit sebagai supplemen tenaga terlindung telah meningkatkan prestasi tumbesaran dan kualiti karkas lembu Bali

tanpa menjejaskan fermentasi rumen dan komposisi asid lemak otot.

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I certify that a Thesis Examination Committee has met on December 2013 to conduct the final examination of Leo Teik Kee on his Master of Science thesis entitled "Supplementation of protected energy on growth performance and carcass quality of Bali cattle (*Bos javanicus*)" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

ADF	acid detergent fiber
ANCOVA	analysis of covariance
CP	crude protein
d	day
DM	dry matter
DNA	deoxyribonucleic acid
EE	ether extract
FA	fatty acid
FAME	fatty acid methyl esters
g	acceleration of gravity
GLM	general linear model
h	hour
ha	hectare
kcal/g	kilo calories per gram
LDL	low density lipoprotein
ME	metabolisable energy
min	minute
M	molar
mmol/L	millimolar per litre
MUFA	monounsaturated fatty acids (monoenoic fatty acids)
µL	microlitre
µm	micrometre
N	normal
NDF	neutral detergent fiber
nm	nanometre
PKC	palm kernel cake
ppm	parts per million
PSI	pounds per square inch
PUFA	polyunsaturated fatty acids
S.E.M.	standard error of means
SFA	saturated fatty acids
UFA	unsaturated fatty acids
v/v	volume for volume
VFA	volatile fatty acids
wk	week

CHAPTER 1

INTRODUCTION

Bali cattle (*Bos javanicus* d'Alton) is a tropical breed belongs to the family of Bovidae. They are indigenous in Indonesia and can be found in small numbers in the northern Australia and Malaysia (Toelihere, 2002). They are relatively large-framed and well muscled. Many scientists have suggested that Bali cattle have several advantages when compared with the other indigenous cattle breeds. Among the advantages are high dressing percentage, high fertility rate, capability of survival and to prosper under poor environmental and climatic conditions in harsh dry land areas such as in the eastern region of Indonesia, and its capacity to maintain the quality of its lean beef (Wirdahayati, 1994). Thus, they are widely used for meat production and work animals in Indonesia.

Bali cattle have been imported into Malaysia since 1971 for the purpose of increasing the population and improving the productivity of the local beef cattle (Johari and Jasmi, 2009). In Malaysia, Bali cattle are reared under the integrated cattle – oil palm production system for cow – calf production and growing – fattening phase. During finishing phase, these animals are subjected to feedlot system to maximize their growth performance, meat yields and to optimise fat deposition. Studies conducted by Mastika (2002) and Mastika et al. (1996) documented improved growth performance and meat quality of male Bali cattle subjected to feedlot finishing system with concentrate supplemented diets.

Finishing diets rely on the inclusion of concentrates to achieve optimal rate of gain and fat deposition due to the limited energy provided by forage (Corah, 2008). However, the rate of gain could be reduced when animals in finishing phase are subjected to inadequate energy intake (Fox and Black, 1984). Therefore, fat is often added to the finishing diets to improve energy efficiency due to the lower ruminal production of methane and direct use of long-chain fatty acids in the metabolic pathways of fat synthesis (Machmüller et al., 2000; Doreau and Chilliard, 1997).

To date, calcium soap of palm oil fatty acids as rumen protected fat has been utilized extensively as an energy source for lactating dairy cows, without imparting rumen function (Jenkins and Palmquist, 1984). Significant improvement in milk production has been observed in dairy cows supplemented with calcium soap of palm oil fatty

acids (McNamara et al., 2003; Fahey et al., 2002). However, decreased average daily gains and feed intake were reported when calcium soap of palm oil fatty acids was fed to feedlot steers (Hill and West, 1991; Ngidi et al., 1990). To date, the effects of calcium soap of palm oil fatty acids supplementation on the growth performance and carcass quality of Bali cattle are yet to be studied. Therefore, the present study was conducted in an attempt to attain the following objective.

Objective

To examine the effects of calcium soap of fatty acids as protected energy supplementation on growth performance, carcass characteristics, rumen fermentation and meat fatty acid composition of Bali cattle subjected to feedlot system.

Hypothesis

Calcium soap of palm oil fatty acids supplemented diet subjected to Bali cattle will improve growth performance and carcass characteristics of the animals.

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