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CARCASS QUALITY, MARBLING AND CHOLESTEROL CONTENT OF MALE BALI CATTLE FED FERMENTED COCOA SHELL

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ABSTRAK

Penelitian ini bertujuan untuk mengetahui kualitas karkas, persentase komponen non karkas, marbling dan kandungan kolesterol daging sapi Bali jantan yang diberi pakan berbasis kulit buah kakao (KBK) fermentasi. Materi yang digunakan dalam penelitian ini adalah 9 ekor sapi Bali jantan berumur 1,5-2 tahun dan berat 165-175 kg. Sapi Bali dibagi secara acak ke dalam 3 kelompok perlakuan pakan. Kelompok P0 diberi pakan mengandung 30% KBK yang difermentasi tanpa tambahan inokulum dan 70% jerami jagung, kelompok P1 diberi pakan mengandung 30% KBK yang difermentasi dengan cairan rumen dan 70% jerami jagung dan kelompok P2 diberi pakan mengandung 30% KBK yang difermentasi dengan Bioplus dan 70% jerami jagung. Semua sapi diberi pakan konsentrat komersial sebesar 1% dari bobot badan. Sapi dipotong pada akhir perlakuan pakan dan dianalisis kualitas karkas dan daging serta komponen non karkasnya. Rancangan penelitian yang digunakan adalah rancangan acak lengkap pola searah. Hasil penelitian menunjukkan bahwa persentase karkas, tebal lemak punggung, *rib eye area* dan indek perdagingan sapi Bali berturut-turut adalah sebagai berikut kelompok PO 53,33%, 3,08 mm, 59,65 cm^2, 0,79%; kelompok P1 52,64%, 5,31 mm, 58,52 cm, 0,82% dan kelompok P2 52,32%, 5,7 mm, 57,75 cm, 0,79%. Adapun marbling dan kadar kolesterol sapi Bali berturut-turut adalah sebagai berikut kelompok PO 2,65% dan 71,25 mg/100g; kelompok P1 2,12% dan 48,75 mg/100g dan kelompok P2 2,63% dan 74,50 mg/100g. Kesimpulan yang dapat ditarik adalah bahwa kulit buah kakao yang difermentasi dapat diberikan pada sapi Bali tanpa mempengaruhi kualitas karkas, non karkas, dan marbling serta kandungan kolesterol daging sapi Bali Jantan, sedangkan kualitas karkas yang terbaik didapatkan pada sapi Bali yang diberi pakan kulit buah kakao yang difermentasi tanpa tambahan inokulum dari luar.

Kata kunci: kakao fermentasi, karkas, marbling, kolesterol, sapi Bali

ABSTRACT

The experiment was conducted to evaluate the effect of fermented cacao shell on the carcass quality, percentage of non carcass components, marbling and cholesterol content of Bali cattle. Nine Bali cattle of 1.5-2 year old and 165-175 kg weight were grouped into three feeding trials. The first group P0 was fed ration containing 30% cacao shell fermented with its own microorganism and 70% corn straw, the second group P1 was fed ration containing 30% cacao shell fermented with ruminal fluid and 70% corn straw, and the third group P2 was fed ration containing 30% cacao shell fermented with Bioplus and 70% corn straw. All cattle were also given commercial concentrate amounting to 1% of their bodyweight. The cattle were slaughtered at the end of feeding trial and their carcasses, meat and non carcass components were analysed. Experimental design used was completely randomized design. The results showed that carcass percentage, back fat thickness, rib eye area and meat index of Bali cattle

were as follows group PO 53.33%, 3.08 mm, 59.65 cm^2, 0.79%; group P1 52.64%, 5.31 mm, 58.52 cm, 0.82% and group P2 5.32%, 5.7 mm, 57.75 cm, 0.79%, respectively. The marbling and cholesterol content of Bali beef were group PO 2.65% and 71.25 mg/100g, group P1 2.12% and 48.75 mg/100g, and P2 2.63% and 74.50 mg/100g. It could be concluded that fermented cacao shell could be used as feed ingredient without any effect on the carcass and meat quality, marbling and cholesterol contents of male Bali beef.

Keywords: fermented cocoa shell, carcass, marbling, cholesterol and Bali cattle

INTRODUCTION

Bali cattle are Indonesian indigenous livestock that readily adapted to tropical environment, have high rate of reproduction and do not select to any kind of feed given (Bandini, 1999). The potency of cacao wastes in Indonesia is very high since the vast area of cacao plantation of 1,852,900 ha with cacao production amounting to 723,000 ton (BPS, 2013) may produce approximately 3.5 million ton cacao waste per year. But utilisation of cacao wastes is still very limited, data in the year 2003 showed that the amount of cacao wastes produced was 1.876.600 ton per year and only 94,503 ton (5.04%) was used for feed of livestock. Actually cacao shell contains relatively high nutrients such as 6-12% crude protein, 27-31% cellulose, 10-13% hemicelulosa and 12-19% lignin. The very low utilization of cacao shell may be due to the antinutritive found in it especially theobromine that toxic to the animal (Indraningsih *et al.,* 2006) and may cause dermatitis.

Cacao shell has to be treated using various ways such as physical, chemical and biological treatments to overcome the disadvantages before being utilised for the livestock (Indraningsih and Sani, 2005). Biological treatment or fermentation of cacao shell have been carried out using commercial inoculums such as EM4, urea, biofit, using various yeast (*Rhizopus stolonifer* LAU 07) to increase the protein content to 16% (Lateef *et al*, 2008), using *Aspergillus spp*, that may decrease the fibers of cacao shell (the amount of crude fiber, NDF, ADF were 33.00, 55.79 and 44.29% respectively) (Alemawor *et al*., 2009), and using *Aspergillus oryzae* to increase the crude protein of cacao shell with 8.74% (Munier, 2009). Rumen of livestock contains microorganisms such as protozoa (76,33 per µl), bacteria (2.3 x 10^8 cfu/g) and fungi (1.9 x 10^3 cfu/g) that can degrade any low quality fiber feedstuffs (Purbowati *et al*., 2014). According to Omed *et al*.(2000) stated that there were many bacteria in ruminal fluid from family of *Bacteriodes, Fusobacterium, Streptococcus, Eubacterium, Ruminococcus and Lactobacillus.* Several studies on ruminal fluid revealed that the addition of ruminal fluid could improve fermentation process (Arora, 1992) and it could certainly be used as inoculum for fermentation process (Gamayanti *et al*., 2012; Purbowati *et al.*, 2014).

Carcass quality was influenced by breed, feed and feed technology, and handling of the carcass itself. Assessment of carcass quality generally through carcass percentage, weight and length of carcass, fleshing index, area of rib area, back fat thickness, score of cattle fatness, score of fat calour, score of meat colour and meat pH (Soeparno, 1998). Standar Nasional Indonesia (SNI) assessed the physical quality of meat based on the meat colour, fat colour, marbling, texture, cholesterol content and microbial meat (BSN, 2015).

To improve carcass quality and marbling of Bali beef cattle in order to utilise the abundant cacao shell, the experiment was needed to carry out. Simple technology (fermentation using several inoculums) was applied on the cacao shell to overcome the antinutritive of cacao shell as well as to improve the quality of cacao plantation waste before being utilised for the Bali cattle.

MATERIALS AND METHODS

Materials

Materials used in the experiment consisted of 9 male Bali cattle (1.5-2.0 year old) with the initial weight of 165-175 kg. Ration for Bali cattle contained the fermented cacao shell. The experiment was conducted at Teaching Farm, Faculty of Animal Husbandry, University of Mataram starting from August to October 2014.

Methods

Fermented cacao shell was prepared as followed: chopped cacao shell was mixed with rice bran 1.5%, urea 0.5% of the cacao shell weight and finally added some water containing inoculums. Mixtures of the ration were then put in

the plastic bag and tightened to make anaerobic condition so that the fermentation process could be achieved. There were 3 types of fermented cacao shell prepared, firstly cacao shell fermented without any additional inoculum, secondly cacao shell fermented with ruminal fluid and lastly cacao shell fermented with Bioplus. Fermentation was carried out for 9 days. Fermented cacao shell was then allowed openly before giving to the cattle. The design of experiment used was completely randomized design.

Nine Bali cattle were divided randomly into three groups of feeding treatments consisting of group PO received ration containing 30% fermented cacao shell without any additional inoculum and 70% corn straw, group P1 received ration containing 30% fermented cacao shell with inoculum of ruminal fluid and 70% corn straw, and group P2 received ration containing 30% fermented cacao shell with inoculum of Bioplus and 70% corn straw. Besides that, all cattle of the three groups were also fed commercial concentrate amounting to 1% of each body weight. All cattle were raised for 1.5 month and at the end of the feeding trial, they were slaughtered according to Islamic halal slaughter method at slaughterhouse (RPH) of Majeluk Mataram. The variables observed were slaughter weight, carcass weight, carcass percentage, back fat thickness (BFT), rib eye area (REA), fleshing index (FI), meat bone ratio (MBR), degree of marbling, and meat cholesterol.

Data Analysis

The data collected were analysed using analysis of variance of Program SAS. Any mean diferrences were analyzed using Duncan New Multiple Range Test.

RESULTS AND DISCUSSION

Carcass Quality of Male Bali Cattle

The results of experiment were presented in Table 1. Statistical analysis showed that rations containing different type of fermented cacao shell did not influence the carcass quality and non carcass percentage of male Bali cattle except the liver percentage ($P<0.05$). Carcass percentage of male Bali cattle fed with fermented cacao shell was relatively high 52.76%, it did not differ from previous studies reported by Wiyatna (2007) 54.0% and Pane (1990) 52-57.7%. Male Bali cattle fed with fermented cacao shell without inoculum resulted in the highest carcass percentage 53.33%. Results of the experiment was also in agreement with the study carried out by Hapid and Rugayah (2009) reported that Bali cattle with body weight of 200-220 kg resulted in carcass percentage of 53.73%. This results also did not differ very much with carcass percentage of various subtropical cattle such as Angus, Belgian Blue, Hereford, Jersey, Limousin, South Devon and Wagyu that possessed carcass percentage approximately 58.13% in average (Afolayan *et al*., 2002).

Bali cattle fed with ration P0 tended to give better carcass quality with higher MBR 3.9:1, larger REA 59 cm^2, and thinner BFT 3.08 mm, whereas cattle group P1 and P2 resulted in lower MBR 3.1:1 and 2.9:1 respectively; narrower REA 58.52 cm^2 and 51.75 cm^2 , respectively. Male Bali cattle of this experiment possessed high MBR. In fact it was comparable to subtropical cattle breed such as Angus, Hereford, Limousin with MBR of

Table 1. Carcass Quality of Male Bali Cattle Fed Ration Containing Different Fermented Cacao Shell

Parameter Observed	Ration Containing Cacao Shell Fermented with		
	No Additional Inoculum (Ration P0)	Ruminal Fluid (Ration P1)	Bioplus (Ration P2)
Carcass weight (kg)^{ns}	98.28 ± 1.06	100.00 ± 4.24	96.00 ± 1.41
Carcass percentage (%)^{ns}	53.33 ± 0.47	52.64 ± 0.12	52.32 ± 0.57
MBR^{ns}	3.9:1	3.1:1	2.9:1
REA (cm^2)^{ns}	59.65 ± 0.64	58.52 ± 3.42	51.75 ± 8.98
BFT (mm)^{ns}	3.08 ± 0.28	5.31 ± 1.40	5.70 ± 0.85
Fleshing Index (%)^{ns}	0.79 ± 0.01	0.82 ± 0.07	0.79 ± 0.01

^{ns} is not significant, MBR=meat bone ratio, REA=rib eye area, BFT= back fat thickness

3.7:1 (Afolayan *et al*., 2002) and Spanish breed with MBR of 4.1:1 (Oliver *et al.,* 2010*)*.

The result of statistical analysis showed that there was not any different on the back fat thickness of Bali cattle fed with ration containing different fermented cacao shell. But Bali cattle of group PO possessed the thinnest BFT 3.08 mm compered to group P1 and P2 with BFT of 5.1 mm and 5.7 mm respectively. Carcass with BFT between 5-7 mm considered as medium carcass grade.

Fleshing index presented in Table 1 showed that all Bali cattle had lower fleshing index 0.79-0.82% compared to the previous study carried out by Wiyatna (2007) that Bali cattle below 3 year old had fleshing index less than 1%, whereas above 3 year old had fleshing index 1.23%. He also reported that Madura, PO and Australian Commercial Cross cattle had the fleshing index of 0.95%, 1.21% and 1,42% respectively. There was not any significant effect of different inoculum on the fleshing index of Bali cattle.

Percentage of Non Carcass of Male Bali Cattle

The percentage of non carcass of male Bali cattle fed ration containing fermented cacao shell were presented in Table 2. The average percentage of non carcass of male Bali cattle fed ration containing fermented cacao shell was 45.38% composed of hide 9.19%, head 5.70%, blood 3.08%, feet 2.70%, liver 2.19%, limfe 0.28%, digestive organs 20.25%, reproductive organs 0.64%, and lungs and heart 1.35%. The percentage of non carcass components of Bali cattle (45,37%) was lower than Java cattle (48,98%) reported by Lestari *et al*. (2010) indicating that Bali cattle possed higher percentage of carcass.

Marbling and Cholesterol Content of Bali Beef Cattle

The results of experiment of marbling and cholesterol content of male Bali cattle fed ration containing fermented cacao shell was presented in Table 3. Analysis of variance showed that type of inoculum did not influence marbling and cholesterol content of male Bali beef. The average of marling of male Bali cattle fed ration containing fermented cacao shell was 2.47%.

Swatland (1984) stated that beef cattle containing 2.5% marbling was categorised as small amount of marbling. The marbling percentages of Bali cattle fed ration containing fermented cacao shell were low since the cattle used in the experiment were still 1.5-2 year old. Fermentation of cacao shell without inoculum produced the higher marbling and lower cholesterol content of Bali beef indicating that

Table 2. Percentage of Non Carcass Male Bali Cattle Fed Ration Containing Fermented Cacao Shell (%)

Parameter Observed	Ration Containing Cacao Shell Fermented with		
	No Additional Inoculum (Ration P0)	Ruminal Fluid (Ration P1)	Bioplus (Ration P2)
Hide ^{ns}	9.10 ± 0.56	9.21 ± 0.33	9.27 ± 0.35
Head ^{ns}	5.70 ± 0.04	5.54 ± 0.25	5.86 ± 0.21
Blood ^{ns}	2.83 ± 0.50	3.10 ± 0.08	3.32 ± 0.16
Feet ^{ns}	2.72 ± 0.08	2.64 ± 0.27	2.73 ± 0.06
Liver	2.25 ± 0.07^{a}	2.45 ± 0.18^{b}	1.86 ± 0.16^{c}
Limph ^{ns}	0.27 ± 0.04	0.29 ± 0.01	0.27 ± 0.06
Digestive tract ^{ns}	20.52 ± 0.12	20.05 ± 0.30	20.17 ± 1.24
Reproduction tract ^{ns}	0.61 ± 0.01	0.66 ± 0.06	0.64 ± 0.11
Lungs and Heart ^{ns}	1.34 ± 0.08	1.29 ± 0.14	1.43 ± 0.14
Total	45.34	45.23	45.55

^{a,b,c} : different superscript at the same row indicates significant (P<0.05)

^{ns} : not signifcant

Tabel 3. Marbling and Cholesterol Content of Male Bali Cattle Fed Ration Containing Fermented Cacao Shell

Parameter Observed	Ration Containing Cacao Shell Fermented with		
	No Additional Inoculum (Ration P0)	Ruminal Fluid (Ration P1)	Bioplus (Ration P2)
Marbling (%)[ns]	2.65 ± 0.92	2.12 ± 0.57	2.63 ± 0.92
Cholesterol (mg/100g) [ns]	38.75 ± 4.27	38.75 ± 2.63	42.00 ± 4.97

[ns] = not significant

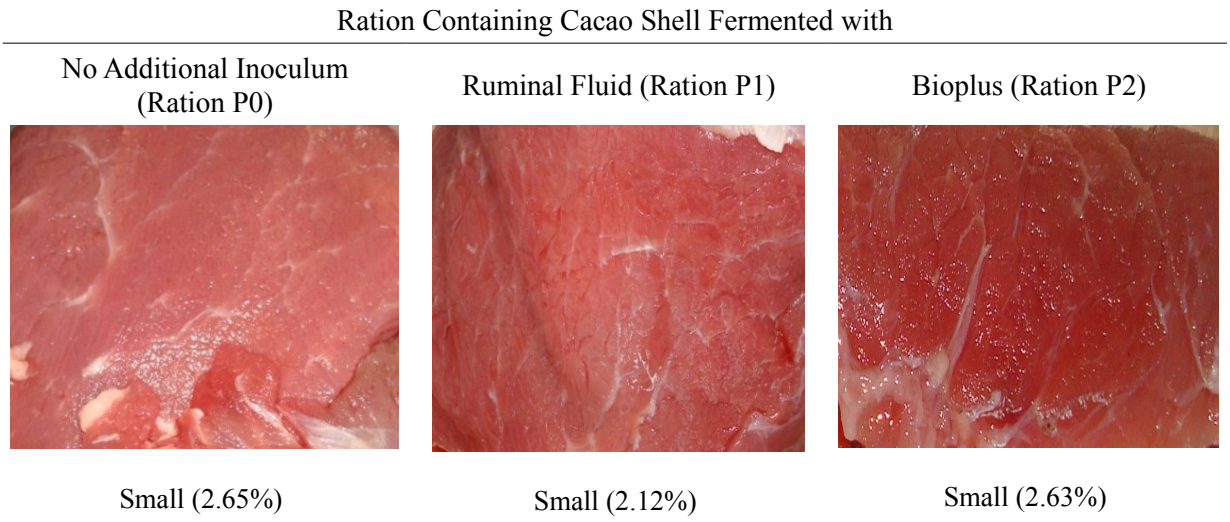

Figure 1. Marbling Evaluated at Rib Eye Area of Male Bali Cattle Fed Ration Containing Fermented Cacao Shell

this simple fermentation might be good alternative to improve cacao shell quality (Figure 1). According to Soeparno (1998) the percentage of intramusculer fat (marbling) usually increased as the percentages of fat tissue and back fat thickness increased. Marbling content was influenced by the feed given to the animals since their life. The cattle that received feed containing cereal tend to result in more marbling and intermusculer fat compared to the animals that fed more grass or roughage.

The results of the experiment showed that the average cholesterol content of meat of male Bali cattle fed ration containing fermented cacao shell was 39.83 mg/100g. This was lower compared to the cholesterol content of beef reported by Saidin (2000) 65 mg/100g and USDA Handbooks (1989) 73.1 mg/100g.

CONCLUSION

Ration containing fermented cacao shell could be given to Bali cattle and produced good carcass and high carcass percentage that comparable to the previous studies. Ration containing fermented cacao shell without additional inoculum resulted in the best carcass in term of the highest MBR and REA, the thinness BFT as well as the lowest non carcass percentage compared to other rations.

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