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Growth, Carcass Production and Meat Quality of Ongole Grade Cattle, Simmental Ongole Crossbred Cattle and Brahman Cross

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ABSTRACT: The experiment was conducted to study the growth rate, carcass production and meat quality of Ongole grade (PO), Simmental Ongole crossbred (SimPO) and Brahman cross (BX) cattle grown in a feedlot system for 3 months. The study were used five head of PO, seven head of SimPO and six head of BX cattle with the respective initial body weight of 307.70+25.72 kg; 353.07+27.95 kg; and 357.00+52.24 kg. The age of cattle about 1.5-2.5 years. The cattle were fed with concentrates and elephant grass. At the end of the experiment all cattle were slaughtered. Meat samples used were Longissinus dorsi (LD) muscles. The variables observed were feed consumption, average daily gain (ADG), feed conversion ratio (FCR), carcass percentage, carcass components, meat physical quality and chemical composition. The obtained data were analyzed by using the analysis of variance of the completely random design and Duncan's new multiple-range test. The results showed that there were significant differences ($P < 0.05$) on the growth variable of feed consumption, ADG and FCR. The feed consumption of BX cattle was higher than PO cattle, but was not significant differences between SimPO and BX, as well as between SimPO and PO cattle. ADG of BX cattle was higher than SimPO and PO cattle. FCR of PO cattle was higher than SimPO and BX cattle, but was not significantly different between SimPO and BX cattle. The percentage of carcass, meat, bone and meat-bone ratio were not significant differences between the cattle breeds. The physical quality of meat (water-holding capacity, cooking loss, tenderness) were significant differences ($P < 0.05$) between the breeds, but the pH did not differ significantly. The meat chemical composition (water, fat, ash content) were not significant differences, but the protein content was differ significantly ($P < 0.05$). It could be concluded that the growth of BX cattle were better than SimPO and PO, but SimPO was better than PO. The meat of PO and SimPO cattle were higher water-holding capacity than meat of BX cattle, but meat of BX cattle was more tender than meat of PO and SimPO cattle.

Key Words: Growth, Carcass, Meat Quality, Ongole Grade Cattle, Simmental Ongole Crossbred Cattle and Brahman Cross.

INTRODUCTION

Indonesia is a potential country to develop beef cattle industry. This development should be supported by several factors, such as feeder cattle, feeds availability, social condition and market opportunities. The breeds of beef cattle in Indonesia feedlot consist of local, crossbred and import cattle. Ongole grade (PO) cattle was local cattle formed as result of grading up between Java cattle and Sumba Ongole (SO) cattle in about 1930. Meanwhile, Simmental Ongole crossbred (SimPO) cattle is the result of crossbreeding between Simmental bull and PO cows by artificial insemination (AI) which has objective to increase the cattle production performance. Brahman cross (BX) cattle is an imported cattle from Australia, which is a result of crossbreeding between Brahman and Hereford-Shorthorn (HS) cattle. In Australia, the BX cattle is stabilised with a content of 50% Brahman, 25% Hereford and 25% Shorthorn bloodlines (Ngadiyono, 2012).

Feedlot or fattening is an exertion of cattle rearing on the final growth stadium, which aims to produce meat production through optimally gain weight by high quality feeding in a brief time (Tillman *et al*., 1998; Ngadiyono, 1995). By the feedlot system, cattle productivity, such as weight

gain, feed efficiency, carcass and meat production can be improved (Dyer and O'Mary, 1977). Genetic and environment factors, including growth, slaughter age, body weight, sex and breed can influenced of meat production. Feed composition and nutrition also influence the growth rate, and proportion of carcass component, specially meat and fat, also nutrition value of meat, including protein, water and fat (Soeparno, 2005).

There are some factors influencing fattening system, such as breed, age, slaughter weight, cattle type, sex, and nutrition (Dyer and O'Mary, 1977). Meat characteristics are determined by the physical quality and chemical composition. Meat characteristics constitutes factors determining the consumer assessment on meat quality, such as pH, tenderness, flavor, texture, aroma, color, cooking loss and water-holding capacity (Crouse, 1989; Soeparno, 2005).

The research was conducted to study the growth rate, carcass production and meat quality of Ongole grade (PO), Simmental Ongole crossbred (SimPO) and Brahman cross cattle grown in a feedlot system.

MATERIALS AND METHODS

The research was conducted by individual pen in Restu Bumi beef cattle fattening which was located at Segoroyoso, Pleret, Bantul, Yogyakarta for three months. Slaughtering of animals were done at Restu Bumi abattoir. The meat analyses were done at the Laboratory of Meat Processing Technology of the Faculty of Animal Science, Gadjah Mada University.

Material used in this experiments were beef cattle, that were five heads of Ongole grade (PO) cattle, seven heads of Simmental Ongole crossbred (SimPO) and six heads of Brahman cross (BX) cattle of about 1.5-2.5 years, with the respective initial body weight of 307.70±25.72 kg, 353.07±27.95 kg and 357.00±52.24 kg.

The cattle's were grown in a feedlot system with a similar diet, namely 15% elephant grass and 85% of concentrate. The concentrate (in asfed) consist of 19.21% rice bran, 14.09% soybean hulls, 63.28% waste product of tapioca (*onggok*) and 3.42% cassava. The ration was given 3% of body weight of cattle and water was given ad libitum. At the end of the experiment all cattle were slaughtered in the abattoir to know the carcass and non-carcass production. The samples of meat were taken from Longissimus dorsi (LD) muscle. The meat samples were tested for physical quality, namely pH degree, water-holding capacity (WHC), cooking loss (CL), and tenderness (shear-force). Chemical composition included water, protein, fat, and ash (mineral). The variables observed were feed consumption, average daily gain (ADG), feed conversion ratio (FCR), carcass percentage, carcass component (meat, bone, and meat-bone ratio), non-carcass, meat physical quality and chemical composition.

The data were analyzed by using the analysis of variance of the completely random design and Duncan's new multiple-range test (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

Feed consumption, average daily gain and Feed conversion ratio

The research of analysis showed that there were significant differences ($P<0.05$) on the growth variable of feed consumption, average daily gain (ADG) and feed conversion ratio (FCR) (Table 1). The DM, CP and TDN consumption of BX cattle was higher than PO cattle, but was not significant differences between SimPO and BX, as well as between SimPO and PO cattle. ADG of BX cattle was higher than SimPO and PO cattle, but SimPO was higher than PO cattle. Soeparno (2005) suggests that growth influencing factors includes genotype, sex, hormone and castration. Moreover, types of feed, consumption, and chemical composition of feed are have a large effect on growth. A high protein and energy consumption will results faster growth rate. FCR of SimPO and BX cattle were lower than PO cattle, but was not significantly different between SimPO and BX cattle. This FCR differences supposed to be resulted by the types of feed, animal's breed and

management. Suwignyo (2003) on BX cattle with hay fermentation and concentrate as the feed which result FCR as much as 9.6-11.4 and Carvalho *et al*. (2010) on SimPO and PO cattle with concentrate and elephant grass which result FCR 18.47 and 22.55. Ideal FCR for cattle with weight of 300 kg is 9 kg/kg gain (Tillman *et al*., 1998).

Table 1. Feed consumption, average daily gain and feed conversion ratio

Variable	Breed of Cattle		
	PO	SimPO	BX
DM (dry matter)			
(kg/head/day)	10.07[a]	11.21[ab]	12.71[b]
(g/kg MBW)[ns]	126.76	124.50	134.44
(% BW)[ns]	2.95	2.78	2.96
CP (crude protein)			
(kg/head/day)	1.41[a]	1.58[ab]	1.79[b]
(g/kg MBW)[ns]	18.95	18.46	20.06
TDN (total digestible nutrients)			
(kg/head/day)	7.02[a]	7.85[ab]	8.94[b]
(g/kg MBW)[ns]	88.30	87.19	94.60
Initial body weight (kg)[ns]	307.70	353.07	357.00
Final body weight (kg)	372.06[a]	455.71[b]	501.36[b]
Average daily gain (kg)	0.59[a]	1.04[b]	1.56[c]
Feed conversion ratio (FCR)	18.20[b]	0.97[a]	8.90[a]

[a,b]Different superscripts at the same row indicated significant differences ($P < 0.05$).
[ns] = non significant; MBW = metabolic body weight; BW = body weight; PO = Ongole grade cattle; SimPO = Simmental Ongole crossbred cattle; BX = Brahman cross.

Carcass and non-carcass component

The research of analysis showed that there were significant differences ($P<0.05$) on slaughter and carcass weight as affected by the breeds of cattle. On the other hand, the percentage of carcass, meat, bone, and meat-bone ratio were not different significant (Table 2). The body weight is correlated to carcass percentage (Soeparno, 2005). The increase of body weight has effect on the decrease of meat and bone proportion in carcass, whereas fat proportion is increased. Fat percentage has negative correlation with bone and meat percentage, but positively correlated to meat-bone ratio (Rusman, 1997). The environmental and genetic factors are highly affecting carcass composition (Berg and Butterfield (1976). PO and SimPO cattle with concentrate and elephant grass which result carcass, meat dan bone percentage were 49.40; 81.31 and 18.93% for PO cattle and 51.18; 81.80 and 18.19% for SimPO, respectively (Carvalho *et al.*, 2010).

Table 2. Carcass and carcass component

Variable	Breed of Cattle		
	PO	SimPO	BX
Slaughter weight (kg)	363.10[a]	456.92[b]	515.66[b]

Carcass weight (kg)	195.00[a]	232.14[b]	250.33[b]
Carcass percentage (%)ns	53.83	50.79	49.36
Meat (kg)	158.20[a]	190.37[b]	207.01[b]
(%) ns	81.06	81.95	82.45
Bone (kg)[ns]	36.80	41.76	43.31
(%) [ns]	18.93	18.03	17.53
Meat-bone ratio[ns]	4.30	4.54	4.81

[a,b]Different superscripts at the same row indicated significant differences (P < 0.05).
ns = non significant; PO = Ongole grade cattle; SimPO = Simmental Ongole crossbred cattle; BX = Brahman cross.

The external dan internal non-carcass percentage of PO, SimPO and BX cattle did not differ significantly. The external non-carcass (blood, head, legs, and hide) were 4.22; 4.97; 2.18; and 8.81% and the internal non-carcass (liver, heart, lungs, kidney, and digestive tract) were 1.11; 0.37; 0.62; 0.22; and 4.96%, respectively. There were not significant difference supposed to be caused by similar quality of feed in three breeds of cattle. Non-carcass components were affected by feed, slaughter weight and sex (Soeparno, 2005).

Meat physical quality and chemical composition

The meat physical quality (water-holding capacity, cooking loss, tenderness) were significant differences (P<0.05) between the cattle breeds, but the pH did not differ significantly. The meat chemical composition (protein and collagen) were significant differences (P<0.05) between meat of PO, SimPO and BX cattle, but the water, fat and ash content were not differ significantly (Table 3).

Table 3. Meat physical quality and chemical composition

Variable	Breed of Cattle		
	PO	SimPO	BX
pH [ns]	5.67	5.68	5.73
Water-holding capacity (%)	10.02[a]	10.18[a]	7.11[b]
Cooking loss (%)	31.50[a]	34.83[b]	36.21[b]
Tenderness (kg/cm^2)	8.69a	7.48[a]	7.23[b]
Water (%) [ns]	69.67	69.69	69.97
Protein (%)	21.94[a]	21.53[b]	21.40[b]
Fat (%)[ns]	6.04	7.60	6.47
Ash (%) [ns]	1.13	0.96	0.90
Collagen (%)	1.67[a]	1.97[b]	1.72[a]

[a,b]Different superscripts at the same row indicated significant differences (P < 0.05).
ns = non significant; PO = Ongole grade cattle; SimPO = Simmental Ongole crossbred cattle; BX = Brahman cross.

Accordingly, the pH values were not significantly different, as also explained by Romans and Ziegler (1974). The pH obtained were generally similar to the normal pH of meat. PO and SimPO cattle had the higher WHC compared with BX cattle. On the contrary, the cooking loss of PO cattle was lower than SimPO and BX cattle. Cooking loss had negative correlation with WHC

and related to the composition of protein and fatty acids (Setiyono et al., 2007). The muscle of BX cattle were more tender compared with PO and SimPO cattle. The differences in tenderness were likely to be due to breed type, muscle structures, contraction status of myofibril and also due to the less tendon and the larger cytoplasm of LD muscle (Soeparno, 2005).

CONCLUSION

The research could be concluded that the growth of BX cattle were better than SimPO and PO, but SimPO was better than PO. The meat of PO and SimPO cattle were higher water-holding capacity than meat of BX cattle, but meat of BX cattle was more tender than meat of PO and SimPO cattle.

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