BODY COMPOSITION OF ONGOLE CROSSBRED GROWING BULL UNDER INTENSIVE FEEDING MANAGEMENT

A. Purnomoadi[1], Bernadette M. Alviani[1], E. Rianto[1], E. Purbowati[1], Soeparno[2]
[1]*Faculty of Animal Agriculture, Diponegoro University*
Kampus drh. Soejono Koesoemowardojo Tembalang,Semarang 50275
[2]*Faculty of Animal Husbandry, Gadjah Mada University*
Jl. Agro Karang Malang,Yogyakarta

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ABSTRACT

The objective of this study was to evaluate the correlation between age and body composition of ongole crossbred growing bull under intensive feeding management. Eight Ongole Crossbred growing bull aged 6-18 months old with initial live weight ranged at 133.5-228 kg were used in this study. They were fed Napier grass (*Pennisetum purpureum*) ad libitum and concentrate feeding at 2.1% of body weight (dry matter basis) which was adjusted to contain 15% protein. The grass was wilted for 7 days prior to feeding. The change of body composition was done in two methods. The first method is histological components by slaughtering animal to measure meat, bone and fat. The second method is chemical composition to determine water, protein and fat. The later body composition was measured during raising under intensive feeding regime for three months and determined by urea space method. The results showed that total meat, bone and fat were increased as cattle age increased, with correlations values between these body components and age were ranged at 0.53-0.72, or if those components were percentaged to the empty body weight, the correlation were 0.04, 0.40 and -0.46, for bone, fat and meat, respectively. These were suggested as a result of different growth rate of body components. In the chemical components, the EBH2O, EBPro and EBFat were ranged at 48.3-53.7% (average 51.22%), 12.5-13.8% (21.54%) and 27.0-34.18% (average 30.38%), respectively, with correlation values were ranged at 0.68-0.69. It could be concluded that during 6-18 m.o. growing period, the growth rate of bone was at the stable rate due to reaching the bone maturity. The weak correlation between age and meat and fat showed that age has small effect on the growth rate, even though fat deposition tended to start and grow in higher rates than that of meat during this age.

Key words: Body Composition, Ongole Crossbred, Growing Bull, Intensive Feeding

INTRODUCTION

Feeding management for beef production mostly was developed based on feed efficiency and daily gain to achieve final body weight only. However, the beef productivity is not considering on body weight only, but the body components such as meat, fat and bone that has a quality effects (Judge *et al.*, 1989). The proportion of these body components was varied. Mature animal contains body water 60%, fat 20% and protein 16% (Pond et al., 2005), while another reported that matures cattle contains water 40-80%, fat 50% and protein 12-20% (Berg and Butterfield, 1976). Rule *et al.* (1986) reported the body water of castrated Angus cattle at 6, 12, and 18 months old were 65.9-70.9%, 52.4-57.3%, and 48.6-54.8%, respectively, while Velazco et al. (1997) observed the body water of Holstein cattle at 6, 9, and 12 months old were 73.83, 51.37 and 43.58%, respectively. In body protein, Pond *et al.* (2005) showed the small decrease (3%) from 19% at birth to 16% at maturity, while Velazco *et al.* (1997) reported the decrease from 20.16% at 3 months old to 18.04% at 9 m.o. and 12.74% at 12 m.o., respectively. These changes also occur in body fat, as reported by Velazco *et al.* (1997), being 18.2 to 24.6% % at 9 to 12 m.o., respectively. Parakkasi (1999) showed the increasing body fat content in cattle from 30% (at 12 m.o.) to 40% (at 18 m.o.). This widely range of fat content by age influence the range of fat content of marketed beef carcass at 18-30% (Price and Schweigert, 1987).

These body components were mainly influenced by age, body weight and growth rate (Taylor and Bogart, 1988, Berg and Butterfield, 1976). As animal age or body weight increased, the number of body components will change and therefore the nutrients requirement would be change (Garret and Johnson, 1983), too. Many study showed that feeding management could manipulate the growth rate (Owen *et al.*, 1993, Brown *et al*., 2005), while inversely body condition (fatness) affected feed intake (Tolkamp *et al.*, 2006). Increasing in animal age followed by increasing proportion (percentage) body fat and decreasing proportion body water, and slightly decreasing body protein (Pond *et al*., 2005).

The explanation above showed that the successful feeding management should be developed based on the knowledge of body composition. In the contrary, however, the effectiveness of feeding management to achieve the production targeted should be evaluated based on the body compositions, such as body water, protein, and fat. Therefore, the study on body composition of Ongole Crossbred cattle at various ages and body weight should be carried out due to the lack of such data.

MATERIALS AND METHODS

Experimental Animal

Eight Ongole Crossbred growing bull aged 6-18 months old with initial live weight ranged at 133.5-228 kg were used in this study. They were fed Napier grass (*Pennisetum purpureum*) ad libitum and concentrate feeding at 2.1% of body weight (dry matter basis). The grass was wilted for 7 days and then was chopped to a 5-10 cm length prior to feeding. The feeding was adjusted to contain 15% protein. The proximate composition of feedstuffs used in the experiment is shown in Table 1. The concentrate feeding was given twice a day, at 0700 and 1500, respectively, while grass was given 2 hours after concentrate feeding. The cattle were adapted to the feeding for one month prior data collection.

Body Composition

The change of body composition was done in two methods. The first method is histological components by slaughtering animal to measure meat, bone and fat. The second method is chemical composition to determine water, protein and fat. The later body composition was measured during raising under intensive feeding regime for three months and determined by urea space method as described by Kock and Preston (1979) with dosage urea dilution followed Panaretto and Till (1963).

A polyethylene catheter was inserted into the jugular vein through an 21-gauge needle. A 0.9% NaCl solution containing 20% urea was prepared for each infusion day. The solution was administered through the catheter over a 2 min period. Volume infused was 0.65 ml per kg $BB^{0.75}$. The catheter was flushed with saline and removed. Before infusion time, a blood sample was collected by jugular puncture. The plasma was stored at -20 ^{o}C until blood urea nitrogen (BUN) was determined. Blood urea-N was determined by Indophenol urease-N method using commercial kit (Bavaria Diagnostica) and read with spectrophotometer.

Urea space was calculated on both a live weight (LW) and empty body weight (EBW) basis using the following equation (Bartle *et al*., 1983):

Urea space (US, %) = mg of urea-N infused / change in BUN x body weight (kg) x 10

Change in BUN was expressed in mg of urea-N/ 100 ml plasma and body weight as either LW or EBW. Change in BUN was calculated by difference be-

Table 1. Proximate Composition of Feedstuff Used in The Present Study.

Feedstuff	Protein	EE	Cfi	Ash	Energy
	-----------------%DM------------------				Cal/g
Napier grass	7.76	6.96	24.73	17.00	3139
Concentrate feed	20.23	6.32	11.36	11.36	3861

tween BUN at 0 and 12 minute after urea injection. Empty body weight was defined as body weight minus the content of alimentary tract. The equation for determining empty body water (EBH2O) following Rule et al. (1986), while for protein (EBPro) and fat (EBFat) were calculated after Panaretto and Till (1963). All parameters, except EBPro (in kg) were expressed as percentage of empty body weight, as follow.

EBH2O (%)= 59.1 + 0.22 x US (%) -0.04 LW
EBPro (%)= 0.265 x EBH2O (kg) – 0.47
EBFat (%)= 98.00 – 1.32 x EBH2O (%)

The cattle were slaughtered and the weight of the gastrointestinal contents (ruminal and large intestinal) was determined. This weight was subtracted from LW to give EBW. Body protein and fat was determined by analyzing non carcass and left side carcass sampled proportionally based on weight of commercial cut. The carcass soft tissue (meat, fat) were separated from bone and thoroughly ground. The water and fat content was analyzed by oven dried 10 g samples at 135 C for 2 hours, proteins was determined by Kjeldahl methods and fat by extraction with diethyl ether, respectively, and were then multiplied to the carcass and non-carcass weight to obtain their total weight.

Experimental Design and Data Analyzing methods.

Cross Sectional Comparison method, a comparison different animal age at the same time, was used in this experiment. The change of body composition was analyzed by comparing the value of body water, protein and fat at 6-18 months old. The data were plotted, and analyzed using correlation regression (Steel and Torrie, 1988) as well as for the strength of correlation value observed.

RESULTS AND DISCUSSION

The Change of Physical Body Composition.

The change of muscle, fat and bone of Ongole Crossbred cattle presented as the correlation between age and physical body composition and are illustrated at Figure 1.

Figure 1 showed that total meat, bone and fat were increased as cattle age increased. The value of correlations between these body components and age were varied, ranged at 0.53-0.72. However, if those components were percentaged to the empty body weight, the correlation were varied, being 0.04, 0.40 and -0.46, for bone, fat and meat, respectively. These were expressed as a results of different growth rate of body components. During the growing period of 6-18 months old, the percentage of bone to empty body weight showing has no correlation with age; fat was positively correlated, while meat was negative. The correlation value observed in bone showed that during the age of 6-20 months, the growth rate of bone was not affected by age, or in another words, the growth rate of bone was varied, from high to slow or could be concluded that at age 20 months the bone growth might reach the stable rate. Meanwhile, the weak correlation between age and meat and fat were in contrast each other, showed that age has no affect on the growth rate, even though fat deposition tended to start during this age and grow in higher rates than that of meat.

Body Chemical Composition

The age of experimental cattle was ranged at 6-20 months (average 12.2 m.o.) giving EBH20 (Empty Body Water) ranged at 48.3-53.7% (average 51.22%), EBFat ranged at 27.0-34.18% (average 30.38%) and EBPro ranged at 12.5-13.8% (average 21.54%). These value was at the normal range according to Rule et al. (1986) that EBH20 of Angus cattle 12 m.o. was 52-57%. Parakkasi (1999) stated that fat of cattle 12 m.o. reach 30%. Body fat and protein of Ongole Crossbred cattle in this experiment was higher than statement of Pond et al. (2005) that mature cattle contain 60% water, 20% fat and 16% protein.

Body Water

During the age 6-18 m.o., body water content of Ongole Crossbred cattle was declining, showed a negative correlation between age and Ongole Crossbred cattle body water ($r= -0.69$; $P<0.05$). This means that as animal age increased, body water was decreased, confirmed some study previously reported (McDonald et al., 1988; Judge et al., 1989). Judge et al. (1989) suggested that decreasing body water is caused by increasing body fat formed by a fat growth in adipose tissue. The observed body water in Ongole Crossbred in this study was lower than that reported

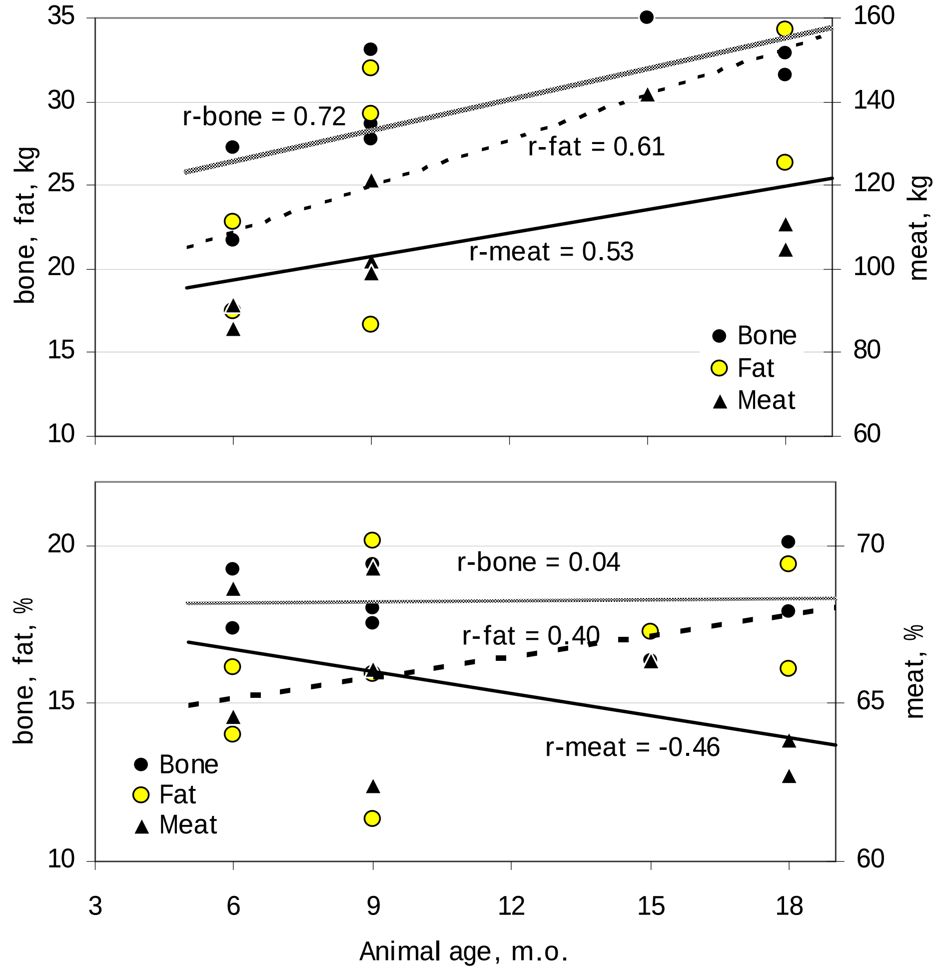

Figure 1. The Change of Physical Composition of Ongole Crossbred Cattle at 6-18 Months Old.

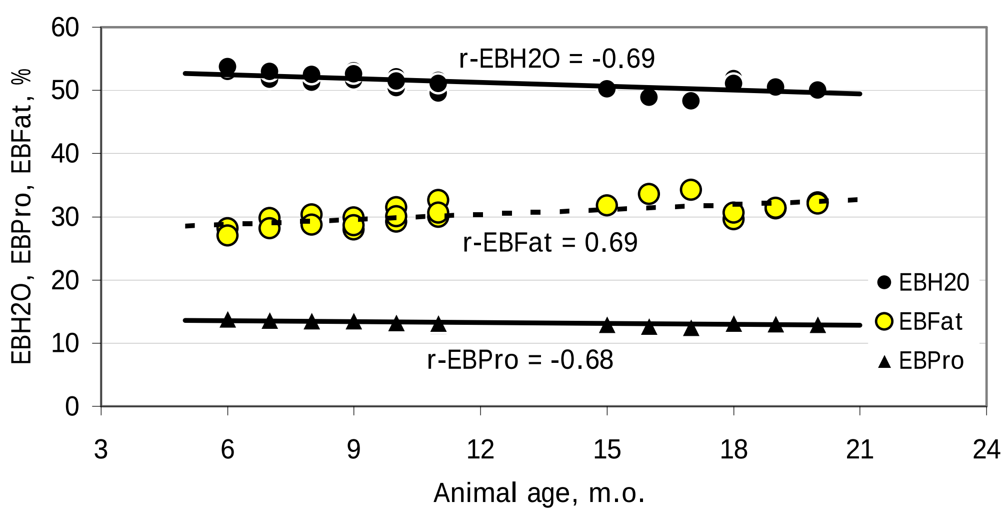

Figure 2. The Change of Body Chemical Components of Ongole Crossbred Cattle in 6-20 Months Old.

in other studies, being 73.83% in 6 m.o. Holstein (Velazco et al., 1997), 65.9-70.9% in castrated Angus (Rule et al., 1986), showing the variation between the breeds.

Body Protein

Empty body protein was correlated with age (r= -0.68) showing a decreasing body protein along with increasing cattle age. Decreasing body protein in the period of age at 6-20 month was 0.8% (from 13.66-13.86% at age 6 m.o. to 12.94-12.98% at age 20 m.o.), suggested the body protein growth of Ongole Crossbred cattle tended to constant. This was agreed the statement of Pond et al. (2005), the range of body protein was small (3%), from 19% at newborn and 16% in mature cattle. This study also was lower than the research of Velazco et al. (1997) in Holstein that found 20.7% (3 m.o.), 20% (6 m.o.), 18.3% (9 m.o.) 16.9% (12 m.o.), was considered as breed differences.

Body Fat

Figure 2 showed the positive correlation between age and body fat (r= 0.69, $P<0.05$), suggested that increasing in animal age may increase fat deposition. The correlation between age and body fat was in contrast with that in body water, both was in similar strength but in different direction. The increase in body fat suggested as increasing in fat content in adipose tissue as a consequences of adipose hypertrophy process. The body fat of Ongole Crossbred cattle at 6 m.o., has the lowest (range at 27.0-30.3%), while the highest (31.8-34.2%) was found at age 15-17 m.o. The increase of body fat content in this study suggested as associated with the high energy intake in this study. The cattle at 6 m.o. has the lowest energy intake (78.5 MJ/d), while the cattle at 15 m.o. has the highest energy intake (111.5 MJ/d), and therefore the growth of body fat was linear with that intake, too. Body fat content of the present study was similar with the report of Parakkasi (1999) showed that fat in 12-18 m.o. cattle reach 30-40%, while Velazco et al. (1997) showed that fat in 9-12 m.o. Holstein cattle reach 18.2-24.6%.

CONCLUSION

Based on the results of this study, the conclusion could be drawn was at 6-18 months old, the body composition (histological and chemical) was correlated, except for percentage of bone. The growth rate of histological and the change of chemical body component at age 6-18 m.o. suggested that Ongole Crossbred cattle was high, except the growth of bone.

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