The potential of growth traits between Limousin and Ongole Crossbred (PO) cattle at Tuban, Indonesia

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Abstract. During growth, cattle increase in weight, size, and also in muscle tissue proportions. Wide variability of carcass traits can be used as base selection on cattle growth. Carcass traits are economical traits that influenced by a complex network of gene interactions in the muscle, and tools such as RNA Sequencing can be used to identify gene interaction for improve important traits. This study aimed to identify the variability of live weight, body measurement and carcass weight of Limousin and PO cattle. A total of 25 animals were used in this research.

The results showed that all of body measurements of Limousin cattle were higher than in PO cattle. Live weight and carcass weight of Limousin cattle were higher than PO cattle. Chest grith and body height had a significant correlation in Limousin cattle, meanwhile all of body measurements and carcass weight were not significant in PO cattle.

The research concluded that PO and Limousin had a different carcass weight.

1. Introduction

One important aspect to develop beef cattle is improving the genetic quality of beef cattle. This aspect need to be done continuously from year to year, especially for Indonesian local beef cattle [1]. Beef cattle not only support economic roles to the farm households, but also become a leading commodity for economy development in Indonesia [2]. The beef cattle business has a focus on increasing meat production to meet consumer needs. It is hoped that beef cattle will produce high body weight and have efficiency, so that it can increase economic value through carcass and meat with good quantity and quality. Fast-growing beef cattle are expected to produce high and efficient body weight gain, so that they can reach the target slaughter weight in a relatively short time. High feed efficiency is also needed because the feed given can be fully utilized by the body [3]. Shorter maintenance time will save feed needs and consumer demand will be fulfilled [4].

Meat production and quality is affected by a number of factors, such as breed, nutrition [5], age [6] ante-mortem treatment of animals, post-mortem treatment and ageing of meat, and cooking methods. The slaughter of livestock meat which is distributed to the public must be carried out in the slaughterhouse and must meet with the principles of Veterinary Public Health (Kesmavet) and animal welfare [7]. Beside that, the variation in the yield of carcass components is related to genetic composition and differences in body size. These differences are the result of inherent breed differences. Breed of cattle was know influenced the growth rate, calf production and reproduction of...
local cattle in Indonesia [8]. Different types of breed require different production systems and the combination of breed and production system result in products differentiated by their quality that very important for the consumer.

Environmental and genetic factors greatly affect the composition of livestock carcasses [9]. According Casas and Kehrli (2016) some genetic traits or conditions are controlled by one gene (monogenic or qualitative traits), while others are controlled by multiple genes (polygenic or quantitative traits) like growth [10]. Growth in beef cattle is a quantitative trait that is influenced by various genes, so it is difficult to predict the role of one gene in influencing growth in cows. RNA-Seq allows analysis to understand the genetic and physiological processes that regulate the phenotype of a quantitative trait in a specific situation. Before that, we must know the growth potential of each breed. Ongole Cattle (PO) is a local cow that has potential to be developed for fulfilled domestic beef needs, beside that are able to adapt well especially in hot tropical climates [11,12]. The study presented here defined the variation of potential in growth and carcass production in PO and Limousin breeds.

2. Materials and methods

2.1. Materials
This study were carried out at Slaughterhouse owned by Tuban Goverment, Tuban, Indonesia. A total of 25 male Limousin and PO cattle were used in this experiment. All cattle were reared by local farmers.

2.2. Collection data
Body length (BL) was measured using measuring stick from distance between the site of pins (tuber ischii) to tail drop (tuberositas humeri). Chest girth (CG) was measured with a tape measure as body circumference of the chest just behind the foreleg. Height (H) is measured using a measuring stick, from the section the highest shoulder over the back of the scapula, perpendicular to the ground. Live weight was predicted using chest girth based on School formula. Bleeding was performed by cutting the jugular vein, aortic artery, esophagus and trachea. The head was cut at the occipto-atlantis joint, the front leg was cut at the carpometacarpal joint and the hind leg was cut at the tarso-metatarsal joint using a cutting knife. Skinning is performed and the evisceration process is performed by dissecting the abdomen. The carcass is divided symmetrically using a carcass saw along the spine into four part. Carcass weight was measured using digital scales.

3. Statistical analysis
The collected data on each animal were analyzed using descriptive analysis. The relationship between body weight and body measurements were estimated by simple correlation and regression. Correlation coefficient of the obtained data was estimated among the carcass weight (CW), body length (BL), chest girth (CG) and body height (BH) by Pearson correlation.

Simple regression model for predicting carcass weight from body length, chest girth and height in each age group of the animals was used as follows:

\[ Y = a + bX \]

Where, \( Y \) = dependent variable of the cattle carcass weight; \( a \) = intercept; \( b \) = coefficient of regression, and \( X \) = independent variable of the animal body measurements, either body length, chest girth and body height.

4. Results and discussion
The results showed that the mean all of body measurement include BL, BH, and CG in Limousin higher than PO cattle (see table 1). LW and CW of Limousin cattle showed in table 2, higher than PO cattle. This showed that with increasing LW, the size of the BL, BH and CG increased, and with the decreasing in the size of the LW, then the size of the BL, BH and CG decreased. Growth usually starts
slowly, then progresses faster, then gradually decreases or slows down and stops after reaching the maturity. According Tama et al (2017) chest circumference is directly related to the chest and abdominal space where most of the animal's body weight comes from the chest to the hips, so the larger the size of the chest circumference, the heavier the body weight [13].

| Table 1. Mean, maximum and minimum body length, body height and chest girth in PO and Limousin cattle. |
|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
| Breed        | Body length (cm) | Body height (cm) | Chest girth |
|--------------|------------------|------------------|-------------|
|              | Mean  | Max  | Min  | Mean  | Max  | Min  | Mean  | Max  | Min  |
| Limousin     | 145.32 | 169  | 127  | 133.47 | 149  | 120  | 186.11 | 203  | 166  |
| PO           | 136.17 | 141  | 126  | 125.50 | 134  | 116  | 157.83 | 170  | 151  |

| Table 2. Mean, maximum and minimum live weight and carcass weight in PO and Limousin cattle. |
|--------------------------------------------------|--------------------------------------------------|------------------|
| Breed        | Live weight (kg) | Carcass weight (kg) |
|--------------|------------------|-------------------|
|              | Mean  | Max  | Min  | Mean  | Max  | Min  |
| Limousin     | 434.16 | 506.25 | 361.00 | 236.83 | 300.40 | 186.90 |
| PO           | 323.85 | 368.64 | 299.29 | 149.72 | 189.40 | 121.00 |

The results showed that higher live weight in Limousin cattle had relationship with higher carcass weight, because live weight is known to affect carcass weight, the higher the live weight, carcass weight increased [14]. Live weight is closely related to growth. Growth is determined by the feed, so that it can produce the maximum slaughter weight. This condition has a very direct influence on carcass weight and carcass percentage, where live weight is correlated with carcass fat percentage, carcass percentage ranges from 50–60% [9]. Limousin cattle were known have a bigger proportion than PO cattle. According to Setiyono et al (2017), a large type of breed will be more fleshy (lean) and have a lot of protein, the proportion of bones is higher and fat is lower than the small type of livestock [15].

The growth pattern of carcass components begins with rapid bone growth, after the cattle reach puberty, the rate of muscle growth decreases and fat deposition increases, so that in the final phase of fattening muscle growth becomes very slow. Differences in carcass weight are related to variations in the rate of deposition of bone, muscle and fat tissue in livestock during the fattening period [16].

| Table 3. Correlation between carcass weight and body measurements on PO and Limousin cattle. |
|--------------------------------------------------|--------------------------------------------------|---------------|
| Breed        | Variable | r  | R² (%) | Coefecient of regression | Significance |
|--------------|----------|----|---------|-------------------------|-------------|
| Limousin     | CW – BL  | 0.15 | 0.02 | Y = 133.64 + 0.05 X     | P>0.05      |
|              | CW – CG  | 0.88 | 0.78 | Y = 119.46 + 0.28 X     | P>0.05      |
|              | CW – BH  | 0.52 | 0.27 | Y = 107.61 + 0.11 X     | P>0.05      |
| PO           | CW – BL  | 0.09 | 0.01 | Y = 139.09 + 0.02 X     | P>0.05      |
|              | CW – CG  | 0.35 | 0.12 | Y = 142.95 + 0.09 X     | P>0.05      |
|              | CW – BH  | 0.73 | 0.54 | Y = 96.95 + 0.19 X      | P>0.05      |

CW: Carcass weight; BL: Body length; CG: Chest girth; BH: Body height.

Table 3 presented the coefficients of correlation between trait pairs of Limousin and PO cattle CW, BL, CG and BH. The correlations between CW with CG and BH in Limousin cattle were significant (P<0.05), but BL was not (P>0.05). Meanwhile, the correlations between all pairs of measurements of CW and body measurement (BL, CG and BH) were not significant (P>0.05).

According to Yosita et al (2012) stated that high body weight in cattle does not always result in a high percentage of carcass [17]. The percentage of carcass is influenced by the amount of water and feed in the digestive tract, if the amount is large enough, the percentage of carcass produced will be low, the large and thick skin also affects the percentage of carcass. The percentage of carcass is
influenced by non-carass weight, the higher the non-carass weight, the lower the percentage of carass weight [18]. This is in accordance with the opinion of Kuswati et al (2014) which states that the non-carass components consisting of the head, both front and hind legs, skin and internal offal can affect the percentage of carass [19].

Another component that can affect the proportion of carasses is gender. Sex class has a significant effect on carass weight, rib eye tendon area, 12th rib back fat thickness and the percentage of kidney, pelvic and heart fat [15]. Gender also significantly affects carass composition and meat quality. Male cattle tend to have a high meat composition with low fat content compared to female cows [20].

5. Conclusion
It could be concluded that Limousin cattle had a higher growth potential than PO cattle. Body measurement, live weight and carass weight of Limousin cattle higher than PO cattle.

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