Analysis of Some Predictors for Estimating Carcass Weight in Brahman Cross Cattle

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Abstract. Carcass weight is an important variable in beef cattle farm, noting that it can only be measured after being slaughtered. A method to estimate the carcass weight is needed in order to reduce losses due to incorrect selection of cattle. The aim of this research is to analyze various variables as carcass weight predictors. The study was conducted at PT. KASA Central Lampung through a survey and field research from 145 cattle consisted of 80 heifers and 65 young steer. The data were collected by direct measurement in the field and added with the production records. The measured variables include carcass weight (CW), chest circumference (CC), body length (BL), body height (BH) and body condition score (BCS) which used as carcass weight predictors. All of the collected data were analyzed with linear and multiple regression to determine the predictors equation, and with one-way classification ANOVA with unbalanced model design by using Minitab software version 13.1. The results showed that sex significantly affect the carcass weight, and the predictors (CC, BL, BH and BCS) analysis showed that all predictors have very high accuracy (P<0.01) by using linear regression. Furthermore, the coefficient of determination (R² adj. is 89.7% for CC, 71.2% for BL, 85.3% for BH, 71.6% for BCS) is lower than multiple regression in predicting the carcass weight (CW = - 470 + 0.748 CC + 0.878 BL + 2.23 BH + 15.5 BCS), with the coefficient of determination at R² adj.>90%. The research concludes that the use of multiple regression with CW, CC, BL, BH, and BCS as predictors in the function would be more accurate compared to the linear regression with similar predictor variables.

1. Introduction

In order to meet the increasing demand for meat, the government is importing both meat and live cattle that will be fattened domestically. One of the most popular cattle breeds that are imported from Australia is Brahman Cross cattle, which is originated from cross breeding the Brahman with Shorthorn, Hereford, Angus or with Beefmaster cattle. This crossbreeding produced a cattle breed which contained Bos indicus and also blood, so they have good growth ability and adaptability towards high temperature and humidity. The imported cattle are generally at young, steer or heifer age. The Brahman cross steer has red and white skin color due to its cross parental characteristics. The proportion of blood from Brahman Cross is 25% Brahman cattle, 25 % Hereford cattle (Bos taurus) and 25% Shorthorn cattle (Bos taurus) [1]. The purpose of crossing in Indonesia is to create a new beef cattle breed for tropical/subtropical regions with superior heterotic characteristics such as high durability (temperature, ticks, and ticks), able to adapt to the tropical environment, and high productivity especially livestock body weight [2]. In addition, the Brahman Cross Cow has a daily body weight gain and a higher percentage of carcasses...
compared to local cattle. PT KASA Lampung is a large beef cattle fattening company in Central Lampung, located in Rengas Village, Tegineneng District. Because the main result of this farm is beef which is fattened in a particular time, then the carcass with high weight is important to note. The aim of the research is to analyze the accuracy of various variables as predictors for carcass weights, so that later they can be used as variables to estimate carcass weights obtained after cutting.

2. Materials and methods

2.1. Data collection
The data were collected through survey and field observation at PT. KASA Indonesia. The measured variables include carcass weight (CW), chest circumference (CC), body length (BL), body height (BH) and body condition score (BCS) through direct measurement and examining the production data recording. The amount of research material is 145 Brahman cross cattle which are consisted of 80 heifers and 65 steers. The daily temperature and humidity data were collected from the recording by BPS weather recording.

2.2. Data analysis
All of the collected data were analyzed by using linear and multiple regression model, then followed with one-way ANOVA in unbalanced classification model by using Minitab software version 13.1. The accuracy of each regression was measured by following formula:

$$\text{Predictors accuracy} = \frac{\text{Estimated and actual carcass weight differences}}{\text{Actual carcass weight}} \times 100\%$$

3. Results and discussion
The seasonal data showed that the minimum daily temperature was 22°C and the maximum was 33°C with relative humidity at 85 to 86% and rainfall at 0 mm.h⁻¹ during August to October 2019 [3]. Such environmental conditions are similar to conditions in their origin, Australia. It is likely that Brahman cross cattle will grow better in colder areas such as in Rockhampton, Queensland where temperatures were ranged between 10°C to 32.2°C. This is noting that Brahman cross contained high Beefmaster characteristics, the first American composite breed (combination of three or more breeds) developed by Tom Lasater in south Texas at 1931. The measured CW, CC, BL, BH, and BCS in this research is presented in Table 1.

| Variables | Mean ± SD     | N    |
|-----------|---------------|------|
| CW (kg)   | 213.32±29.58  | 145  |
| CC (cm)   | 152.91±7.49   | 145  |
| BL (cm)   | 134.64±6.44   | 145  |
| BH (cm)   | 153.86±6.04   | 145  |
| BCS       | 6.956±0.3504  | 145  |

The results indicate that the carcass weight in this study is higher than the results of the study of Harapin and Priyanto [4] and Setiyono et al. [5] where for heifer was weighed at 129 kg and steer at 119 kg. The difference is presumably due to the better feeding management in PT KASA where most of the given feed in the form of onggok has been made into silage prior to feeding.

3.1. Accuracy of variables as predictors for carcass weights
The predictor analysis in the form of linear and multiple regression in this study are presented in Table 2.
Table 2. Linear regression analysis between predictor variables and multiple regression analysis of all variables with carcass weights

| Variable | Regression equation | $R^2_{adj.}$ (%) | Accuracy (%) |
|----------|----------------------|-------------------|--------------|
| CC       | $CW = -326 + 3.53\, CC$ | 79.8 (P<0.001)    |              |
| BL       | $CW = -308.790 + 3.88\, BL$ | 71.2 (P<0.001)    |              |
| BH       | $CW = -483.483 + 4.53\, BH$ | 85.3 (P<0.001)    |              |
| BCS      | $CW = -284.26 + 71.53\, BCS$ | 71.6 (P<0.001)    |              |
| All      | $CW = -470 + 0.748\, CC + 0.878\, BL + 2.23\, BH + 15.5\, BCS$ | 90.4 (P<0.001)    |              |

The results showed that all variables have individual relationship to the carcass weight, however measuring all of the predictor variables in multiple regression showed higher accuracy ($R^2_{adj.}>90\%$) compared to the linear regression. In addition, the results of the study showed that by using multiple regression a carcass weight estimation with only about 0.095 % error will be achieved.

4. Conclusion
The research concludes that the use of multiple regression with CW, CC, BL, BH, and BCS as predictors in the function would be more accurate compared to the linear regression with similar predictor variables.

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