The effect of slaughter age and sex class to carcass characteristic of Red Brahman Crossbred Cattle

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Abstract. This research was conducted to examine the effect of slaughter age and sex class to carcass characteristic from Red Brahman Crossbred Cattle. The research materials were 126 heads (grouped by slaughter age (<1.5 years, 2–2.5 years, and 3 years) and sex class (bull and steer)) with taken from KASA Company, rested for 12-24 hours, and slaughtered in AM FARM abattoir with halal MUI slaughter methods. The research method was used field experiment. The data of research were analysis by using Complete Randomized Factorial Design (2X3) and Duncan Multiple Range Test if there were differences. Parameters of carcass characteristic were slaughter weight, hot carcass weight, dressing percentage, carcass components percentage (meat, bone, fat), MBR, MFR, rib eyes area, and 12th fat thickness of ribs. The results of this research showed that slaughter age and sex class has significantly (P<0.05) affect to slaughter weight and hot carcass weight. Interactions of slaughter age and sex class has significantly (P<0.05) affect dressing percentage, bone and meat percentage, MBR and MFR, and has not significant (P>0.05) rib eyes area and fat thickness. From these results, it can be concluded that slaughter age and sex class affect carcass characteristics of Red Brahman Crossbred Cattle.

Keywords: slaughter age, sex class, carcass characteristic, red brahman crossbred cattle

1. Introduction

Beef cattle are a livestock commodity that has an important role in meeting the country’s meat demand. Indonesia gets its beef from the slaughter of local beef cattle (carcass and offal) as well as imports. [19] reported that local beef production from 2018 to 2019 had decreased by 0.76%. The low amount of beef production is only able to meet the national beef consumption needs of 65% - 70%, according to data from [19] and [6] that the level of beef consumption in Indonesia has increased from 2018 of 2,518 kg/capita/year and 2,56 kg/capita/year in 2019. Based on these data, it is known that beef production is lower than the need for meat, causing a shortage of meat supply by 25% or 169.336.558.13 kg/year (2018) and 29% or 195.849.886.40 kg/year (2019). Efforts made by the government to meet the shortage of national beef supply include importing beef in accordance with [22] in the form of frozen beef and feeder cattle.

Brahman Cross Cattle (BX) is one of the Australian feeder cattle breeds from 3 breeds (50% Brahman, 25% Hereford and 25% Shorthorn) [4] with a variation such as sex class (steer, bull, heifer, cow, etc.), frame size (light, feeder, medium, heavy, super heavy) and color (red and white). The reasons for the high interest in importing feeder Brahman Cross Cattle (BX) in Indonesia are due to their ability
to produce higher economic value than local cattle, namely faster growth, superior carcass (the proportion of meat and bones is higher than fat) and the Average Daily Gain value. (ADG) is optimal in a short period of time (3–4 months), so that the Brahman Cross (BX) feeder is in great demand by Indonesian feedlots for fattening [10]. The Red Brahman Crossbred (BX) is one of the color variations that the Brahman Cross Cattle. The difference in color variations is due to the results of the crosses of their parents, where the red Brahman Cross cattle color comes from a mixture of Gir and Indu-Brazil with some Guzerat influence [2].

Carcass consists of muscle tissue, fat, bone and residual components such as tendons, connective tissue, blood vessels, and nerves [18]. Several factors affect the characteristics of beef cattle carcasses during feedlot maintenance and slaughtering at the slaughterhouse, such as breed, sex, age, slaughter weight, feed nutrition, climate and management system as well as the level of livestock stress [13]. Heritability of beef cattle production that are passed down from parent to calf must be supported by an optimal environment so that genetic, environmental and the combination of both can produce optimal heritability values for beef cattle production. The value of the decline in the characteristics of beef cattle production includes carcass value of 48%, meat tenderness of 61%, thickness of fat by 38%, and the area of Longissimus dorsi by 70% [18]. Estimates of the heritability of carcass production characteristics must take into account the age of the cattle, sex class and the depth of fat during slaughter [20]. Therefore, it is necessary to evaluate the carcass production of Brahman Cross cattle in Indonesia at the age of slaughter (PI<sub>0</sub> to PI<sub>4</sub>) and sex (steer and bull) to determine the characteristics of the carcass produced.

2. Materials and methods

2.1. Research location

This research was conducted on January 1<sup>st</sup> – April 1<sup>st</sup>, 2021 at the Karunia Alam Sentosa Abadi Company (PT KASA), Kampung Rengas, Bekri District, Central Lampung, Indonesia and AM FARM abattoir, Gadingrejo Village, Pringsewu, Lampung, Indonesia.

2.2. Research materials

The materials used in the study were 126 Red Brahman Crossbred Cattle (BX) from Karunia Alam Sentosa Abadi Company (PT KASA), where Brahman Cross cattle were grouped by age (PI<sub>0</sub>: < 1.5 years; PI<sub>2</sub>: 2 – 2.5 years; and PI<sub>3</sub>: 3 years) and sex class (Steer and Bull) so that each group consists of 21 heads. Another criteria were the feed ration given was a standard complete feed (concentrate, silage, and supplements) during the maintenance period and Red Brahman Cross Cattle resting process was carried out for 12-24 hours and slaughtered by the halal method and restraining box mark 4 at AM Farm abattoir for carcass evaluation.

2.3. Research methods

The research method used was a field experiment. The data were analyzed with Complete Randomizes Factorial Design (2x3) and continued with the Duncan Multiple Range Test if there were differences.

2.4. Research procedures

This research procedures with the selection of cattle based on the research criteria then resting for 12 hours in holding pen. The next process is slaughtering cattle with Halal MUI method at restraining box mark 4 at AM Farm abattoir for carcass evaluation. The process of slaughtering began with driving the cattle from the holding pen to the mark 4 box and then clamping the cattle. Cutting the ventral part of the neck (near the mandible) so that the 3 tracts (esophagus, trachea, jugular vein, and carotid artery) were completely cut off in one incision. The next process is exsanguination and observed signs of death after cutting, separating the head on the osipal bone with the first nape, the four legs, hanging cattle on the achilles tendon and os olecranon, skinning process, separating fat (chest fat, trimming fat, and digestive fat), and the evisceration process. Cutting the carcass into 4 pieces (hindquarter left,
hindquarter right and forequarter left, forequarter right) then weighed each part to get carcass weight. Deboning and weighing so that the weight of the carcass components is obtained. Measuring the thickness of the back fat using a ruler and rib eye area in the Longissimus dorsi muscles on ribs 12 and 13 by drawing on tracing paper.

2.5. Data analysis
The evaluated parameters of Red Brahman Crossbred Cattle were slaughter weight, hot carcass weight, dressing percentage, carcass composition percentage (meat, bone, fat), meat bone ratio, meat fat ratio, rib eyes area, and fat thickness of ribs 12th. Slaughter weight value from weighing cattle before slaughter. Analysis of hot carcass weight from weighing all parts of 4 pieces carcass and dressing percentage of hot carcass weight divided by slaughter weight multiplied by one hundred percent. Carcass components percentage analysis (meat, bone, fat) are weighing all carcass component parts after deboning then divided hot carcass weight multiplied by one hundred. MBR and MFR values from comparing weight of carcass components (meat, fat, bone). Analysis of back fat thickness by reading the measurement result on a ruler converted to mm. Analysed of rib eyes area by redrawing in millimeter block to calculate and convert from mm to cm².

3. Results and discussion

3.1. Carcass Weight
Slaughter weight (kg) and hot carcass weight (kg) are important indicators in evaluating carcass characteristics of Red Brahman Crossbred Cattle. The effect of some of these indicators on the carcass characteristics of Red Brahman Crossbred Cattle with different treatment of slaughter age (Pl₈, Pl₂ and Pl₃) and sex (steer and bull) can be seen in Table 1.

**Table 1.** Slaughter weight, hot carcass weight, and dressing percentage of Red Brahman crossbred steers and bulls as affected by different sex class and slaughter age.

| Parameter                  | Sex class | Slaughter age | Average       |
|----------------------------|-----------|---------------|---------------|
| Slaughter Weight (kg)      | Steer     | Pl₀ (<1.5 years) | 480.19 ± 54.90 | 520.95 ± 32.98 | 506.14 ± 54.29 | 502.43 ± 50.62<sup>a</sup> |
|                            | Bull      | Pl₀ (<1.5 years) | 454.43 ± 28.00 | 506.14 ± 54.29 | 470.43 ± 42.60 | 477.00 ± 47.60<sup>a</sup> |
|                            |           | Pl₂ (2–2.5 years) | 506.14 ± 54.29 | 470.43 ± 42.60 |           |               |
|                            |           | Pl₃ (3 years)    |               |               |               |               |
| Average                    |           |               | 467.31 ± 45.01<sup>a</sup> | 513.55 ± 44.99<sup>b</sup> | 488.29 ± 51.47<sup>ab</sup> |               |
| Hot Carcass Weight (kg)    | Steer     | Pl₀ (<1.5 years) | 273.80 ± 31.94 | 295.45 ± 22.43 | 293.63 ± 31.18 | 287.63 ± 30.05<sup>b</sup> |
|                            | Bull      | Pl₀ (<1.5 years) | 262.60 ± 16.56 | 293.63 ± 31.18 | 268.61 ± 23.36 | 274.95 ± 27.60<sup>a</sup> |
|                            |           | Pl₂ (2–2.5 years) | 293.63 ± 31.18 | 268.61 ± 23.36 |           |               |
|                            |           | Pl₃ (3 years)    |               |               |               |               |
| Average                    |           |               | 268.20 ± 25.76<sup>a</sup> | 294.54 ± 26.84<sup>c</sup> | 281.12 ± 30.01<sup>b</sup> |               |

<sup>a,b,c</sup> Different superscripts at the same row indicated significant differences (P<0.05).

Pl = Permanent incisors

Slaughter weight is the final weight obtained from the weighing results before slaughtering cattle. The results of the analysis showed that the interaction between sex and slaughter age has not significant (P>0.05), although the factors of sex and slaughter age has significant effect (P<0.05) on the slaughter weight of Red Brahman Crossbred Cattle. Overall, the average slaughter weight of Red Brahman Crossbred Cattle on the steer was 502.43 kg, which is greater than that of bulls was 477 kg. The type of feeder used for the steer group was medium steer with an initial weight 350 kg - 400 kg and for bull groups was used feeder bull with an initial weight 300 kg. The difference in slaughter weight of steer Brahman Crossbred Cattle is higher than bull because the feeder types used have different weights and accumulated muscle formation due to hormone action [18]. Table 1 states that Red Brahman Crossbred Cattle with slaughtering age of 2–2.5 years (Pl₃) has the highest average slaughter weight was 513.55kg, while those at slaughter age < 1,5 years (Pl₀) has the lowest average slaughter weight was 467, 31 kg. The reason that the slaughter of Red Brahman Crossbred Cattle on 2 – 2.5 years (Pl₂) or phase leading
up to puberty until the end of puberty because in this phase the proportion of bones has decreased, the proportion of meat has experienced optimal growth and the proportion of fat is still constant (not yet increased), so that the resulting slaughter weight is higher than the slaughter age of PI4 and PI0. Increasing the age will provide opportunities for cattle to grow and reach maturity optimally so that increasing age affects the growth of organs, especially muscles, bones, and fat [14].

Carass weight is obtained after weighing and deboning the carcass components in the form of meat, fat, bones [1]. Based on the analysis data in Table 1, it shows that the interaction of sex and slaughter age factors has not significant (P>0.05), while the factors of sex and slaughter age has significant effect (P<0.05) on hot carcass weight. The average hot carcass weight of Red Brahman Crossbred Cattle steer was 287.63 kg, which is greater than that bull was 274.95 kg because the slaughter weight steer was higher than bull. This is in accordance [13] that half carcass weight of the bull is lower than that of the back and that the weight of the head is heavier which causes the proportion of bull carcass to be lower than the steer. Another factor is the difference in feeder weight and cutting weight in this study, where the weight of feeder (medium steer) and cutting weight of steer are higher than that of feeder bull and cutting weight of bull. [18] stated that hot carcass weight is influenced by slaughter weight, where an increase in slaughter weight will be followed by an increase in carcass weight due to growth in cattle which must be supported by feeding with good nutrition according to the age of livestock growth. Table 1 states that the best average hot carcass weight PI2 was 294.54 kg compared to PI0 was 268.20 kg and PI4 was 281.12 kg. Slaughter age PI2 was highest value of hot carcass weight because cutting is done in the phase before puberty (sexual maturity), where meat growth has increased, bone growth has decreased and fat is still (has not increased) so that the proportion of meat and bone that dominates carcass weight can be obtained optimally [10]

3.2. Proportion of Carass Components
Carass is part of the body of livestock without the head, legs (metatarsus and metacarpus), skin, digestive organs, blood, and kidneys with the main components of carcass consisting of muscle tissue (meat), bone and fat and the combination of the three determining a balanced carcass composition [5], [15], and [18]. Several parameters for evaluating the carcass of the Red Brahman Crossbred Cattle are dressing percentage, percentage of carcass components (meat, bone, and fat), meat bone ratio (MBR), meat fat ratio (MFR), rib eyes area (REA), and fat thickness ribs 12th. Data analysis of some of these parameters with the effect of sex treatment and different slaughtering age on the carcass of Red Brahman Crossbred Cattle can be seen in Table 2.
Table 2. Dressing percentage, percentage of carcass components (meat, bone, and fat), meat bone ratio (MBR), meat fat ratio (MFR), rib eye area (REA) and fat thickness rib 12th of Red Brahman Crossbred steer and bull as affected by different sex class and slaughter age.

| Parameter          | Sex class | Slaughter age | Average |
|--------------------|-----------|---------------|---------|
|                    | PI₀(0-1.5 years) | PI₁(1.5-2 years) | PI₄(2-3 years) |
| Dressing Percentage (%) | Steer | 57.05 ± 2.31<sup>a</sup> | 56.71 ± 2.34<sup>a</sup> | 58.03 ± 1.41<sup>a</sup> | 57.26 ± 2.11 |
|                    | Bull | 57.79 ± 1.16<sup>a</sup> | 58.03 ± 1.41<sup>a</sup> | 57.14 ± 1.84<sup>a</sup> | 57.65 ± 1.52 |
| Average            | Steer | 57.42 ± 1.84<sup>a</sup> | 57.37 ± 2.02<sup>a</sup> | 57.59 ± 1.68<sup>a</sup> | 57.65 ± 1.52 |
| Bone Percentage (%) | Steer | 23.44 ± 2.67<sup>ab</sup> | 24.07 ± 3.17<sup>ab</sup> | 24.92 ± 2.61<sup>b</sup> | 24.14 ± 2.85 |
|                    | Bull | 23.95 ± 2.16<sup>ab</sup> | 24.92 ± 2.61<sup>b</sup> | 23.14 ± 2.48<sup>a</sup> | 24.00 ± 2.50 |
| Average            | Steer | 23.70 ± 2.41 | 24.49 ± 2.90 | 24.03 ± 2.67 |
| Meat Percentage (%) | Steer | 70.60 ± 2.60<sup>a</sup> | 69.95 ± 3.30<sup>a</sup> | 69.01 ± 2.58<sup>a</sup> | 69.97 ± 2.47 |
|                    | Bull | 70.06 ± 2.13<sup>a</sup> | 69.01 ± 2.58<sup>a</sup> | 70.85 ± 2.43<sup>a</sup> | 69.91 ± 2.67 |
| Average            | Steer | 70.33 ± 2.36 | 69.48 ± 2.96 | 6.93 ± 2.64 |
| Fat Percentage (%) | Steer | 5.94 ± 0.26 | 5.87 ± 0.24 | 6.06 ± 0.22 | 5.96 ± 0.24 |
|                    | Bull | 5.98 ± 0.12 | 6.06 ± 0.22 | 6.00 ± 0.45 | 6.01 ± 0.29 |
| Average            | Steer | 5.96 ± 0.20 | 5.97 ± 0.24 | 6.03 ± 0.35 |
| Meat Bone Ratio    | Steer | 3.06 ± 0.51<sup>a</sup> | 2.97 ± 0.58<sup>a</sup> | 2.80 ± 0.35<sup>a</sup> | 2.94 ± 0.49 |
|                    | Bull | 2.95 ± 0.36<sup>a</sup> | 2.80 ± 0.35<sup>a</sup> | 3.10 ± 0.41<sup>a</sup> | 2.95 ± 0.39 |
| Average            | Steer | 3.01 ± 0.44 | 2.89 ± 0.48 | 2.95 ± 0.41 |
| Meat Fat Ratio     | Steer | 11.90 ± 0.61<sup>a</sup> | 11.92 ± 0.88<sup>a</sup> | 11.39 ± 0.55<sup>a</sup> | 11.74 ± 0.73 |
|                    | Bull | 11.70 ± 0.38<sup>a</sup> | 11.39 ± 0.55<sup>a</sup> | 11.97 ± 0.60<sup>a</sup> | 11.69 ± 0.56 |
| Average            | Steer | 11.80 ± 0.51 | 11.66 ± 0.78 | 11.68 ± 0.64 |
| Rib Eyes Area      | Steer | 9.27 ± 1.08 | 9.39 ± 1.52 | 8.60 ± 1.23 | 9.09 ± 1.32 |
|                    | Bull | 9.45 ± 1.20 | 8.80 ± 2.42 | 9.33 ± 1.81 | 9.19 ± 1.87 |
| Average            | Steer | 9.36 ± 1.13 | 9.10 ± 2.02 | 8.97 ± 1.57 |
| Fat Thickness      | Steer | 1.05 ± 0.21 | 1.00 ± 0.16 | 1.06 ± 0.24 | 1.04 ± 0.20 |
|                    | Bull | 1.04 ± 0.14 | 1.12 ± 0.22 | 1.03 ± 0.14 | 1.06 ± 0.17 |
| Average            | Steer | 1.04 ± 0.18 | 1.06 ± 0.20 | 1.05 ± 0.20 |

<sup>ab</sup>Different superscripts at the same row indicated significant differences (P<0.05).

PI = Permanent incisors

The research of analysis showed that the interaction between sex and slaughter age has significant (P<0.05) effect on the dressing percentage of Red Brahman Crossbred Cattle. The best interaction with the average dressing percentage of steer PI₄ and bull PI₂ were 58.03%, while the lowest interaction value of steer PI₂ was 56.71%. Based on the results of the study, the dressing percentage steer PI₄ and bull PI₂ were greater than steer PI₄ because the slaughter weight and hot carcass weight of steer PI₄ and bull PI₂ were lower than steer PI₄. [18] Dressing percentage is influenced by the slaughter weight and hot carcass weight. The dressing percentage can be found by calculating the hot carcass weight divided by the slaughter weight then multiplied by one hundred percent. Sex and slaughter age factors in Table 2 show that there is has not significant effect (P>0.05) on the dressing percentage of Red Brahman Crossbred Cattle. The average dressing percentage of steer and bull were 57.26% and 57.65%, while the dressing percentage of slaughter age PI₀, PI₂, PI₄ were 57.42%, 57.37%, and 57.59%. Table 2 shows that the dressing percentage was ideal category. This is accordance with [10] that one of the criteria for livestock
has a high economic value if it is able to produce dressing percentage was 52% - 58% or 50% - 60% of slaughter weight [18]. [3] Dressing percentage optimal that can be achieved for beef cattle is 62%. Compared with the results of research [12] that the dressing percentage of Red Brahman Crossbred Cattle is 49,36%. The difference dressing percentage in this study is due to differences in the resulting chunks of carcass. Carcass cuts in this study namely meat, bones and fat (breast fat and trimming fat), were inversely proportional to carcass for industry which only consisted of meat and carcass bones. The standard of carcass cut in each region can be different because it is adjusted to market needs so that it affects the dressing percentage produced. Carcasses with fat can increase dressing percentage by 3-7% [11]. The average value of dressing percentage PI4-PI4 steer percentage was 57,26% higher than the results of research by [22] that the average dressing percentage of Brahman Crossbred Cattle steer PI0-PI4 was 55,01%. The difference of average dressing percentage is due to differences in feeder types, day on fattening, feed intake, slaughter weight, the cutting method used, and carcass handling after slaughtering [11] and [14].

Bone is one of components dressing percentage Dressing percentage is obtained from carcass weight compared to slaughter weight multiplied by one hundred [10]. The interaction between sex class and slaughter age has significant (P <0,05) effect on the bone percentage of Red Brahman Crossbred Cattle. Table 2 states that the best average bone percentage was bull PI4 by 23,14%, while the highest bone percentage was steer PI4 by of 24,92%. The bone percentage steer PI4 was higher than bull PI4 because slaughter weight, hot carcass weight and dressing percentage on steer PI4 higher than bull PI4. In addition, the feeder type used for the steer group was medium steer with an initial weight 350 kg - 400 kg and bull group use feeder with an initial weight 300 kg. [10] state that differences body size of livestock can affect the proportion of carcass components including the bone proportion. Sex and slaughter age has no significant effect (P>0,05) on the bone percentage of Red Brahman Crossbred Cattle. The average bone percentage steer was 24,14% and bull was 24%. The results of this study were higher than the previous results studies from [9] that the distribution bone percentage steer was 14.82% and bone proportion Red Brahman Crossbred Cattle was 17.53% [12]. Another research [14] that the bone percentage in beef cattle were bull by 16% and steer 15%. The difference proportion of bone percentage is due to several factors such as differences proportion of feed intake, type and weight of feed used, the method of slaughtering and handling performed at the time of slaughter [18].

Meat is a part skeletal muscle of beef carcass, which is safe, fit for consumption, and is one of the components that dominates the formation of a livestock carcass (meat index) and evaluation of carcass production performance [10]. The percentage of meat can be calculated from the weight of meat divided by slaughter weight and multiplied by one hundred percent [11]. Table 2 states that the interaction of sex and slaughter age factors has significant effect (P <0,05) on the meat percentage of Red Brahman Crossbred Cattle with the best interaction value was Bull PI4 by 70,85%, while the lowest interaction was steer PI4 by 69,01%. The meat percentage of bull PI4 was higher than steer PI4 because the slaughter weight, hot carcass weight and dressing percentage of bull PI4 was higher than steer PI4. This is in accordance with [18] that the same slaughtering age on Brahman Crossbred Cattle with high slaughter weight will produce high dressing percentage, high bone percentage and high fat percentage so the percentage of meat produced is lower than cattle with low slaughter weight. Bull characteristics have more efficient level of feed consumption so that the slaughter weight and proportion of meat percentages are higher than steer [20]. Table 2 states that sex class and slaughter age has not significant (P>0,05) on the meat percentage of Red Brahman Cross Cattle with the average percentage was 69,91% to 70,33%. Based on the research, the meat percentage was on ideal group. [18] states that proportion meat percentage of Brahman Cross Cattle is 70% - 75%, but it is different from [3] that the optimal meat percentage is 60.8% and [12] that meat percentage Brahman Cross Cattle by 82.45%. The difference proportion of meat percentage is due to several factors, namely feed intake during maintenance, slaughter age, type and weight of feeder, method of slaughter, and handling and method of cutting carcass [11].

Fat is a component of carcass, which the most recently growing and has increased along with the increase slaughter weight and age of the livestock. Sex class, slaughter age and their interaction has not
significant (P>0.05) on the fat percentage of Red Brahman Crossbred Cattle. The average value fat percentage of steer was 5.96% and bull was 6.01%. The difference fat percentage in the result of study was lower than the research [13] that the fat percentage were bulls by 13% and steers by 25% because the effect of completed feeds and finisher supplements given to livestock on final phase. [17] that the proportion 80% of grain feed and supplements can increase the slaughter weight and the percentage of carcass composition is better, especially fat percentage. In general, fat percentage of steer is higher than bull due to the influence of the hormone testosterone which decreases due to castration so that growth of fat increases compared to muscle and bone proportion [18]. The best value fat percentage of Red Brahman Crossbred Cattle was PI2 by 5.87% compared to PI0 by 5.94% and PI1 by 6.06%. According to the research [22] that the fat percentage of steer PI0 was 9.13%, steer PI2 was 9.79% and steer PI4 was 11.24%. From two studies, it is known that the best fat percentage on PI0 and PI4, which means that the best time to slaughter of Red Brahman Cross Cattle in the high puberty until it reaches post puberty because low fat percentage produced [18]. [10] and [7] stated that the maximum growth of livestock occurs after reaching puberty (mature age of cows) which is marked by a decrease in bone growth and an increase in meat growth and low fat deposition.

Meat bone ratio (MBR) is a relatively constant individual indicator of bone weight [15], where MBR is obtained from converting carcass meat weight divided by bone weight [10]. on Meat Bone Ratio (MBR) of Red Brahman Crossbred Cattle. The best average of MBR value was Bull PI1 by 3.10 and include on low MBR category (3.5 :1). The results of this study indicate that MBR value on low MBR category, namely 3.5: 1 [10]. Based on the results of this study, the recommended slaughter ages for optimal MBR on PI0 or the phase before puberty (bone growth decreases and meat increases) [18]. Table 2 states that the factor of sex class has not significant (P<0.05) to MBR, with the average value on steer was 2.94. In contrast to the research [9] that the average MBR steer value is 4.6 and [12] is 4.81, where the average MBR results from the two previous studies fall into the ideal MBR category, namely 4: 1 [10]. The different MBR values were due to differences in the percentage of meat and the percentage of bone, where in this study the low meat weight and high bone weight were compared to the two previous studies which had a higher meat proportion and lower bone proportion. Other factors that because differences meat and bone proportion are feed weight, slaughter weight, slaughter age, type and feed intake, different cutting and carcasses method which have an impact on the meat and bone percentage and different MBR values [18].

Meat Fat Ratio (MFR) is a calculation used to determine the proportion of meat and fat in carcass. Based on the results of data analysis in Table 2 that the factors of sex class has not significant (P>0.05) on Meat Fat Ratio (MFR) of Red Brahman Crossbred Cattle. The average MFR value were steer by 11.74 and bull by 11.69. The results showed that MFR steer was higher than bull because influence of hormone performance. [14], stated that castration treatment on the steer causes the hormone testosterone to decrease which affects an increase on fat percentage and decrease meat and bone percentage so it has an impact on increasing MFR value. The research from [10] showed that MFR value of Brahman Cross Steer Cattle was 9.64. The difference of average MFR results from the two studies was due to differences in weight and type of feeder, slaughter age, type and amount of feed given, and slaughter weight in livestock. Table 2 states that the interaction of sex class and slaughter age factors has significant effect (P<0.05) on the MFR value of Red Brahman Crossbred Cattle. The best average MFR value on bull PI2 and steer PI4 was 11.39, this is because interaction slaughter age and sex class in bull PI2 and steer PI4 was 11.39 has high of meat percentage and lower of fat percentage, so the MFR value is low. The factor slaughter age has not significant (P>0.05) to MFR. The MFR value on PI2 and PI4 because on high puberty or adulthood phase, where the proportion of bone decreases, meat increases and fat still constant so MFR value is low [18].

The rib eye area is one of the productive characteristics carcass, while it’s passed on from parents to children by 70% and has a relationship with the proportion of meat proportion [10]. Rib eyes area can be determined by measuring on Longissimus dorsi muscle area (12th and 13th rib) using a grid, the Longissimus dorsi section can provide an indication of the proportion of meat, thickness of back fat, and quality of meat [15] and [8]. Table 2 state that The factor sex class, slaughter ages and the interaction
of two factors has not significant effect (P>0,05) on the rib eyes. The factor sex class has rib eyes area value on bull was 9,19 cm² or 11,93 inch² and steer was 9,09 cm² or 11,84 inch², so that it can be seen if the meat proportion of bull was higher and fat proportion was lower than steer, and two both of the results include on the normal rib eyes area of rib 12th category. The rib eyes area value in this study is in accordance with [16] that the REA bull value was 12,08 inch² and steer was 11 inch² so that it can be seen if the meat proportion of bull was higher and fat proportion was lower than steer. It is inversely proportion to research [17] that the rib eyes area value of Red Brahman Crossbred cattle was 130,39 cm² or 14.21 inch². The difference rib eyes area values from these studies is due to differences slaughter weight, hot carcass weight, sex class, feed given, fat proportion, cutting of carcass methods [18]. Table 2 state the factor slaughter ages has not significant effect (P>0,05) on rib eyes area, with the average value of rib eyes area ware PI₀ by 9,36 cm² or 12,04 inch², PI₁ by 9,10 cm² or 11,87 inch² and PI₁ by 8.97 cm² or 11,79 inch². Based on this study, the rib eyes area value on rib eyes area ideal category, according to [16] that the rib eyes area score ideal was 10 inch² to 18 inch². From Table 2, it is known that the best average REA value is PI₁ to PI₁, which means that the best separation is at the age of PI0 and PI1 or before adult sex to sexual maturity, because that on phase muscle growth increases compared to fat and bone so that rib eyes area was also significant increase on dressing percentage, especially the meat proportions [10].

Fat thickness rib is one productive characteristics of carcass that can be passed down from parent to child by 38% which serves to predict the amount of fat covering on carcass, protect carcass damage, increase meat tenderness, and predict the eating quality [18] and [1]. Assessment of the fat thickness rib can be carried out by subcutaneous fat on the rib 12 (Longissimus dorsi) in the transverse position and using millimeter ruler [8]. Table 2 states that sex class, slaughter ages and the interaction of the two factors has not significant effect (P>0,05) on fat thickness rib, with the fat thickness rib value of the Red Brahman Cross was 1,04 mm to 1,06 mm. Based on these results, it is known that fat thickness rib 12th on very lean category with a score of <1 - 1 mm [18]. In contrast with research by [17], that fat thickness rib of = Cross steer PI1 was 13,38 mm and on fat thickness very fat category (12 - > 12 mm). The differences fat thickness rib from the two studies due to differences in sex class, slaughtering age and slaughter weight. The factor slaughter age of livestock is related to day on fattening (Days on Fattening), where the longer of DOF can increases the higher of fat thickness rib [18], so the recommended slaughtering age for fat thickness rib 12th optimal was PI₀. The factor sex class of steer has fat thickness of rib 12th than bull cattle and lower than heifer [13]. This is different from this study that fat thickness of rib 12th on steer and bull has not significant (P>0,05), this was due to differences feed given during the study in the form of standard complete feed: concentrate, silage and supplements. Feed nutrition has an effect on the fat proportion in carcass, where the higher the energy of the ration, the higher the subcutaneous fat (proportion of carcass fat) and causes a decrease in the proportion of meat proportion [18]. The difference is due to differences in sex class, slaughter ages, slaughter weight, hot carcass weight, fat percentage and feed given during the fattening period [10].

4. Conclusion
Based on the results of the study, it can be concluded that the factor slaughter age and sex class has significant on slaughter weight and hot carcass weight carcass, but has not significant on rib eyes area and fat thickness rib 12th. The interaction factors of slaughter age and sex class has significant on carcass percentage, bone percentage, meat percentage, MBR and MFR. From these results, it can be concluded that slaughter age and sex class real effect to carcass characteristics of Red Brahman Crossbred Cattle.

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