Observations of Bali Cattle Carcass Size Based on Different Body Condition Scores at Kendari Slaughter House

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ABSTRACT

This study aims to assess the influence of the score on the body condition of Bali cattle that shall be slaughtered at Kendari city especially on a linear measure of the body and the percentage of the carcass. The study is done in four months from January to April 2021 at the slaughterhouse Kendari city Southeast Sulawesi Province. The study is done with observation assessment score the condition of the body of cattle. Research variables observed namely body weight, carcass weights, the percentage of the carcass, front of the thigh circumference, the circumference of the hamstrings, the length of the quadriceps, the length of the hamstrings, long the bones of a canon, and circumference of a canon. The data obtained were analyzed using a Randomized Complete Design with unequal replication. The research results show that the condition of the body the score 2, 3 and 4 influential very real against body weight carcass weights, the percentage of the carcass, in circumference the quadriceps and a canon. in circumference while effects on the circumference the hamstrings influential real. The influence of not real shown at length the quadriceps, long the hamstrings and long bone cannon.

Keywords: *Bali Cattle, the Score Condition Of The Body And Slaughterhouses Kendari City.*

1. INTRODUCTION

The population of beef cattle in Southeast Sulawesi is dominated by Bali cattle and a small portion of them still have crossbreed cattle. Bali cattle are one type of livestock that is widely kept because it is part of the agricultural system that is inseparable from agricultural activities in rural areas. Bali cattle have the ability to adapt to bad environmental conditions and the ability to produce meat and carcasses are good. Bali cattle are raised for economic purposes, namely as beef cattle (meat) and as breeders [1] [2].

Southeast Sulawesi Province is one of the development areas for Bali cattle. The type of beef that is commonly kept by farmers in Southeast Sulawesi is Bali cattle. Generally, the community maintains cattle extensively and a small part of the community maintains it semi-intensively. The population of beef cattle in the last five years in Southeast Sulawesi has increased by an average of 16.35%, from 298,692 in 2018 to be 357,086 in 2020. Population growth is far above the national average growth of only 3.07% [3]. However, aspects of carcass and meat quality in Southeast Sulawesi have not been given much attention either by producers (breeders), butchers, retailers and consumers [3] [4].

Bali cattle are one type of livestock that are widely kept because they are part of the livestock system agriculture is inseparable from agricultural activities in rural areas. Bali cattle have the ability to adapt to extreme environmental conditions and the ability to produce good meat and carcass. Bali cattle are raised for economic purposes, namely as beef cattle (meat) and as breeders. Adult body weight reaches 300–400 kg with a carcass percentage of 56.9%. In addition to having the advantage of having Bali cattle susceptible to Jembrana disease and the mortality rate of pre-weaning calves of 15% to 20% [5]. In general, the cattle slaughtered in Kendari City are Bali cattle. According to the observation of the slaughtering process for 6 months at the Kendari City Slaughterhouse (RPH), it was found

that the most slaughtered cattle were Bali cattle (97.7%).

Beef cattle are considered good if it produces carcass with optimal quantity and quality [6]. Carcass production can describe the success of beef cattle rearing/fattening, because it shows the productivity of beef cattle in producing meat which as a whole has high economic value [7].

One way to assess the productivity of cattle is to look at the body condition score. A general scoring system that has been developed to estimate the average condition of cattle in rearing is the definition of a body condition score. This system assists farmers in assessing the condition of livestock by evaluating the value of fatness and skeletal prominence [8].

Body condition score is a visual assessment method that considers frame size or body shape [9]. Cattle with high body condition scores will produce more carcass and meat than those with lower scores. Thus, fat cattle will produce more carcasses [10].

This study aims to examine the effect of body condition score on linear size and carcass percentage of Bali cattle slaughtered in Kendari City Slaughter House.

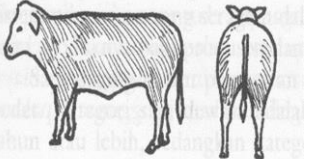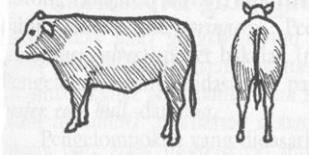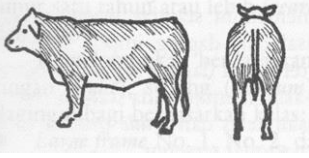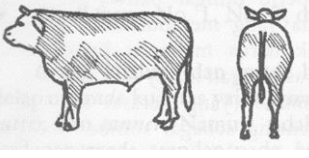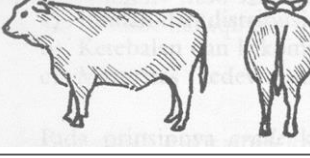## 2. MATERIALS AND METHODS

2.1. Research Material

The subject matter used in this study was Bali cattle which were slaughtered at the Slaughterhouse Anggoeya Village, Poasia District, Kendari City. Observations were made on 90 Bali cattle in the shelter for slaughterhouses regardless of gender. The equipment used consisted of knives, weight and meat scales, writing instruments and digital cameras.

2.2. Research Procedure.

Assessment of the body condition score or SKT of cattle is carried out at night before being slaughtered at night. Body condition scores were classified into five groups of body condition scores, namely very thin (score 1), thin (score 2), moderate (score 3), fat (score 4) and very fat (score 5). Determination of body condition score is based on AMLC-APFINDO on table 1 [2][10][11] :

Before the cattle are slaughtered, inspection ante mortem to be declared fit for slaughter. This research procedure is based on the method used by Hafid *et al.* [12][13]. At the beginning of the study, all the tools and materials prepared before slaughter were first weighed

Table 1. Cattle Appearance

Score		Cow Appearance	Information
1	Very Thin		Cattle have The pelvis is narrow and angled, the ribs, spine and ribs are very prominent, there is no fat in the brisket, the flank and twist are very light in development.
2	Thin		Cattle have a narrow pelvis and elbows, sitting bones, spine and ribs are very clear, the chest (brisket) is thin and not fat, the curve of the hungry bend and the base of the tail is very clear, the development of fat in the abdomen (flank) and thigh gap (twist) is absent. covered in fat
3	Currently		Cattle have adequate appearance, the pelvis, sitting bones, spine and ribs are covered in thin fat, the hungry bend and the base of the tail begin to be less visible, the chest, abdomen, and thigh gaps begin to fill with fat
4	Fat		Cattle have a soft closure over the hips. Tsit back, spine and ribs show a good appearance. Fat is more prominent near the base of the tail. The flank is fuller under the stifle joint. Brisket, twist and fuller scrotal area.
5	Very Fat		Cattle have a dense and deep appearance, there is a heavy fat covering (grub) on the hips, ribs, spine and ribs. Very much fat covers the base of the tail. The chest, abdomen, and thigh gaps are full of fat and protruding.

and then slaughtered in Islam by cutting the neck and cutting the carotid artery, jugular vein and oesophagus and trachea to get perfect bleeding.

Separation of the head and four legs at the joint of the canon bone. Skinning can be done by peeling on the floor. Skinning begins with a slice3stretch of the skin along the midline of the chest and abdomen, then the incision is continued along the inner (medial) surface of the leg. The skin is separated from the ventral and length of the body. To remove organs except for the kidneys from the abdominal cavity (abdomen) and chest.

After slaughtering, skinning and evisceration, the meat from the beef carcass was weighed such as: hash, flank, breast, quadriceps and hamstrings, all of the meat was added together to obtain the warm carcass weight. To obtain the total meat and bones, each part is separated between the meat and bones and then weighed. In this study, the fat content of the carcass could not be measured and blended with the meat due to the unavailability of a chilling room in the slaughterhouse.

2.3. Research Parameter

The parameters observed in this study are as follows:

1. Body weight (kg), which is the result of weighing the cattle before slaughter.
2. Carcass weight (kg), which is the result of weighing the carcass of cattle that have been slaughtered.
3. Carcass percentage (%), ie the weight of the carcass obtained through the weighing process divided by live weight multiplied by 100%.
4. Quadriceps circumference (cm), which is the measurement of the circumference of the quadriceps out of the body.
5. Hamstring circumference (cm), which is the measurement of the circumference of the hamstrings outside the body.
6. Quadriceps length (cm), i.e. size 3the length of the front thigh to the calf bone joint.
7. The length of the hamstrings (cm), i.e. size 3 the back of the thigh to the calf joint.
8. The length of the canon bone (cm), which is the carcass distance from the shoulder bone (*Tuberculum humeralis lateralis*) to the carpometacarpal joint.
9. Canon circumference (cm), which is the size of the canon bone circumference measured on the left foot.

2.4. Research Design and Data Analysis

The experimental design used in this study was a completely randomized design. In connection with this, the treatment is the body condition score (BCS) of Bali

cattle according to Hafid's instructions, namely [14] [15]:

BCS 2 = Skinny (Score 2)
BCS 3 = Medium (Score 3)
BCS 4 = Fat (Score 4)

The mathematical model of this design refers to Mattjik and Sumertajaya (2002), namely:

$$Yij \ Y_{ij} = \mu + \alpha_i + \varepsilon_{ij} \qquad (1)$$

Information :

Yij = Observations on parameter
μ = General mean
α_i = Effect of the i-th treatment (i= 0, 1, 2, 3, 4)
ε_{ij} = Effect of error from treatment

Furthermore, to see the difference between treatments, it was continued by using the Honestly Significant Difference Test (BNJ) according to Mattjik and Sumertajaya [16].

3. RESULTS AND DISCUSSION

The average value of research variables on the effect of body condition scores on body weight, carcass weight, carcass percentage, quadriceps circumference, hamstring circumference, quadriceps length, hamstring length, canon bone length and cannon bone circumference in Bali cattle can be seen in Table 2.

3.1. Body Weight

Body weight is the weight obtained as long as the cattle is kept and alive [9]. Cattle body weight is one indicator of livestock productivity that can be estimated based on the linear size of the cattle's body. The results of the analysis of variance show that the body condition score has a very significant effect (p<0.01) to body weight of Bali cattle. The results of this study indicate that the body condition score has a significant effect on the body weight of Bali cattle.

The highest body weight in this study was found in body condition score 4 while the lowest was in body condition score 2. Further test results showed that each body weight on body condition scores 2, 3 and 4 were different from each other. This means that the higher the body condition score, the higher the body weight of Bali cattle.

Differences in the body weight of different adult beef cattle will result in different levels of fatness at the same age and diet [17]. The difference in body weight is due to differences in daily body weight gain, the average feed consumed by each individual, the amount of muscle gain each day and differences in the amount of fat that has been stored by the body. These differences will make the body composition of livestock different [18].

Table 2. The average effect of body condition scores on body weight, carcass weight, carcass percentage, quadriceps circumference, hamstring circumference, quadriceps length, hamstring length, canon bone length and cannon bone circumference

No	Research Variables	Body Condition Scroe		
		2	3	4
1	Number of Cattle (Head)	30	30	30
2	Body Weight (Kg)	166.7^a	196^b	263^c
3	Carcass Weight (Kg)	64.5^a	94.8^b	150.2^c
4	Carcass Percentage (%)	38.7^a	48.2^b	56.9^c
5	Quads Circumference (Cm)	32.2^a	39.9^b	41.7^b
6	Back Thigh Circumference (Cm)	52.3^a	58.1^b	63.5^c
7	Quads Length (Cm)	83.5^{tn}	83.8^{tn}	84.2^{tn}
8	Thigh Length (Cm)	79.8^{tn}	80.1^{tn}	80.5^{tn}
9	Cannon Bone Length (Cm)	32.3^{tn}	34.2^{tn}	35.2^{tn}
	Cannon Circumference (Cm)	16.3^a	18.1^b	18.5^b

Note:
- Different superscript letters in the same line showed very significant differences ($p < 0.01$)
- tn showed no significant difference ($p > 0.05$)

Cattles should be slaughtered at the optimum time for the breeder, i.e. when the body weight and body composition produced are in balance with the feed and costs incurred [19]. The increase in body weight will be followed by an increase in carcass weight and cause an increase in carcass production. It is reported that 75-80% of carcass diversity is determined by body weight [20] [21].

Bali cattle have high reproductive rates, excellent adaptability to poor feed conditions and hot environments and have good carcass percentage and meat quality. Adult body weight reaches 300–400 kg with a carcass percentage of 56.9% [5]. Meanwhile, Bali cattle can reach a height of 130 cm with a body weight of about 250-400 kg, while for adult females it ranges from 250-300 kg [22].

3.2. Carcass Weight

Carcass weight is one of the important parameters in the carcass evaluation system. As an indicator, the carcass is not a good predictor of carcass productivity due to variations in the type of breed, nutrition and type of tissue growth, resulting in a decrease in accuracy.

Carcass weight is important used in the carcass evaluation system. The use of carcass weight needs to be combined with other indicators so that carcass evaluation results in an accurate assessment [9]. The results of the analysis of variance show that the body condition score has a very significant effect ($p < 0.01$) on the carcass weight of Bali cattle. The results of this study indicate that the body condition score has a significant effect on the carcass weight of Bali cattle.

The highest carcass weight in this study was found in body condition score 4 while the lowest was in body condition score 2. Further test results showed that each body weight on body condition scores 2, 3 and 4 were different from each other. This means that the higher the body condition score, the higher the carcass weight of Bali cattle. In accordance with the results of research explained that carcass weight is largely influenced by muscle weight and muscularity greatly determines the condition of the animal's body. Carcass weight is also strongly influenced by live weight before slaughter, based on the higher the slaughter weight, the carcass weight will also increase. The carcass weight for Brahman cross cattle reaches 225 kg [23].

The main components of the carcass that are expected are the maximum proportion of meat, optimal fat proportion and minimal bone proportion. In general, the assessment of carcass yields is done through the percentage of the carcass. The higher the carcass percentage, the better the carcass performance [11].

The research results stated that the average carcass weight of male and female Bali cattle were 119.24 kg and 113.01 kg, respectively [7]. The carcass weight of male Bali cattle aged 3-3.5 years is 174 kg, while female Bali cattle aged 3-3.5 years have a carcass weight of 139.67 kg. When compared to livestock male Bali cattle at maturity, female Bali cattle have a lower carcass weight. This is thought to be caused by the faster growth rate of male cattle and higher slaughter weight compared to female cattle.

3.3. Carcass Percentage

Carcass percentage is the ratio between carcass weight and live weight multiplied by 100%. The percentage of the carcass is influenced by carcass weight, livestock weight, condition, breed of livestock, the proportion of non-carcass parts, ration given and method of slaughter [11].

The results of the analysis of variance show that the body condition score has a very significant effect (p<0.01) to the percentage of Bali cattle carcass. The results of this study showed that the score of body condition had a significant effect on the percentage of Bali cattle carcass. The highest carcass percentage in this study was found in body condition score 4 while the lowest was in body condition score 2. Further test results showed that each body weight on body condition scores 2, 3 and 4 were different from each other. This means that the higher the body condition score, the higher the percentage of Bali cattle carcass.

The results of the research carcass percentage of Bali cattle aged 2.5–3.5 years was 53.26% [24]. In general, the increase in body weight of cattle shows a directly proportional relationship with the percentage of cattle carcass where the heavier the live weight of the cattle, the higher the percentage of the carcass will increase. This is in accordance with the opinion of which states that the main components of the carcass consist of muscle tissue (meat), and bone where the speed of bone and beef growth will occur at the age of 1-3 years and stop at the age of 3 years. This growth rate will affect the body weight of the cattle where there is a relationship between live weight, carcass weight and carcass percentage. The higher the live weight, the higher the carcass weight [25].

Furthermore, the percentage of male cattle carcass is greater than that of female cattle because physiologically male cattle have a larger body skeleton and muscle and fat tissue [26]. This is in accordance with what was stated by research that fat accumulation occurs after the animal reaches body maturity, namely after the growth of bone and muscle tissue is complete, followed by fat formation. Therefore, cattle slaughtered at the age of 1½-2½ years have a higher percentage of meat because they have not accumulated fat.

The results of Qalbi's research that the average percentage of male and female Bali cattle carcass weights are 56.80% and 55.68%, respectively [7]. States that the average percentage of the beef carcass is 56% of the body weight of the cattle, and the percentage of carcass produced consists of 37.5% meat components and the remaining 18.5% is bone and fat components [27].

3.4. Quads Circumference

Assessment of body condition scores was grouped according to the level of the fatness of Bali cattle with categories 1 (very thin), 2 (thin), 3 (moderate) 4 (fat) and 5 (very fat). The results of the research conducted showed that in Kendari City RPH there were only 3 categories of body condition scores, namely categories 2, 3 and 4. The results of the analysis of variance show that the body condition score has a very significant effect (p<0.01) to the circumference of the quadriceps of Bali cattle. The results of this study indicate that the body condition score has a significant effect on the circumference of the quadriceps of Bali cattle.

The largest quadriceps circumference in this study was found in body condition score 4 while the smallest was in body condition score 2. Further test results showed that Bali cattle quadriceps circumference score on body condition score 2 was different from body condition score 3 and 4, while body condition score 3 is not different from the body condition score 4. This means that the higher the score of body condition, the greater the circumference of the quadriceps of Bali cattle. The higher the circumference of the quadriceps is most likely due to the high body condition score of the cattle with better rotation than the low body condition score. At a high body score, the quadriceps circumference of the cattle was drowned by fat, causing a significant difference with a low body score. There is a condition that the score of 5 livestock shows "fat" body performance, where the body skeleton and bone structure are not visible and not palpable. The tailbone has been sunk by fat and the rectangular shape of the hindquarters has arched at both ends. In this body condition, livestock will be able to produce and not be disturbed by seasonal changes [28].

This is in accordance with the results of research explaining that carcass weight is largely influenced by muscle weight and muscularity greatly determines the condition of the animal's body. Carcass weight is also strongly influenced by live weight before slaughter, the higher the slaughter weight, the carcass weight will also increase.

3.5. Thigh Circumference

The results of the analysis of variance show that the body condition score has a significant effect (p<0.05) to the circumference of the back thigh of Bali cattle. The results of this study indicate that the body condition score has a significant effect on the circumference of the back thigh of Bali cattle.

The largest hamstring circumference in this study was found in body condition score 4 while the smallest was in body condition score 2. Further test results showed that each hamstring circumference at body condition scores 2, 3 and 4 was different from each

other. This difference can be caused by the coverage of nutrients obtained by an animal. Bali cattle that get good nutrition coverage will get a good body condition compared to Bali cattle whose nutritional adequacy is less fulfilled. Nutrition and feed composition affect the growth rate of livestock which will be converted into muscle/meat and fat. In body condition 4 (fat) the nutritional needs of livestock are met compared to body score 2 (thin) so that there is a difference in the thigh circumference of Bali cattle. The speed of livestock growth is strongly influenced by the amount of feed consumption. Lack of feed is a big obstacle in the growth process. Livestock need feed nutrients that meet the requirements, namely protein, carbohydrates, fats, minerals, vitamins, and water. Nutrients in the feed are used for basic life,

Growth, production and quality of carcasses are largely determined from livestock rearing to post-slaughter handling. Genetic and environmental factors including growth, cut size, body weight or carcass, sex and breed of livestock can affect the production and quality of meat produced. Nutrition and feed composition also affect the growth rate. Likewise, differences in muscle fiber size between muscles that make up meat also show differences in carcass and meat quality [15] [29].

3.6. Quads and Back Length

The results of the analysis of variance showed that the body condition score had no significant effect (p>0.05) to the length of the front and hind thighs of Bali cattle. The results of this study indicate that the body condition score has no effect on the length of the front and back thighs of Bali cattle.

The length of the quadriceps on body condition scores 2, 3 and 4 were 83.50 Cm, 83.80 Cm and 84.20 Cm, respectively. The highest body condition score is 4 and the lowest body condition score is 2, but statistically does not show a significant difference. While the length of the hamstrings on body condition scores 2, 3 and 4, respectively, was 79.83 cm, 80.10 cm and 80.50 cm, respectively. The highest body condition score is 4 and the lowest body condition score is 2, but statistically does not show a significant difference. There is no difference between the length of the forelimbs and hind legs of Bali cattle in body conditions 4, 3, and 2 because body condition scores have no effect on bone length in cattle and The observed cattle were estimated to be of the same age and cattle that had matured, their bone bodies had no longer developed so that the linear size of the cattle's body.

This refers to the statement that body parameters and carcass properties of beef cattle at different body conditions have almost the same linear body size because these cattle were measured at the age of more

than four years. The cattle have almost the same linear body size but have different slaughter weights. These differences may be due to the different deposition of muscle and fat between different body conditions [9].

The age of bulls at the time of puberty varied among cattle breeds, with a range from 8 to 18 months and body weights of 350 to 450 kg. Cattles over four years old are those that have passed the maturity of the body and have stable bone and muscle growth. Linear body size in adult cattle is not a good indicator when used to predict body weight. Cattles that have experienced maturity, their bone bodies have not developed anymore so that the linear size of the cattle's body is relatively constant [30].

3.7. Canon Bone Length

The results of the analysis of variance showed that the body condition score had no significant effect (p>0.05) to the bone length of canon Bali cattle. The results of this study indicate that the body condition score has no effect on the bone length of the canon Bali cattle.

The bone length of the canon on body condition scores 2, 3 and 4 were 32.33 Cm, 34.20 Cm and 35.20 Cm, respectively. The highest body condition score is 4 and the lowest body condition score is 2, but statistically does not show a significant difference. There is no difference between cannon bone length in Bali cattle in body conditions 4, 3, and 2 because body condition scores have no effect on cannon bone length in cattle. There is no difference between the bone length of canon Bali cattle in body conditions 4, 3, and 2 because the body condition score has no effect on cannon bone length in cattle and The observed cattle were estimated to be of the same age and cattle that had matured, their bone bodies had no longer developed so that the linear size of the cattle's body.

This refers to the statement that body parameters and carcass properties of beef cattle at different body conditions have almost the same linear body size because these cattle were measured at the age of more than four years. The cattle have almost the same linear body size but have different slaughter weights. These differences may be due to the different deposition of muscle and fat between different body conditions [9].

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so that the linear size of the cattle's body is relatively constant [28].

3.8. Canon Circumference

The results of the analysis of variance show that the body condition score has a very significant effect ($p<0.01$) to the circumference of the Bali cattle canon. The results of this study indicate that the body condition score has a significant effect on the circumference of the Bali cattle canon.

The largest canon circumference in this study was found in body condition score 4 while the smallest was in body condition score 2. Further test results showed that the Bali cattle canon circumference score on body condition score 2 was different from body condition score 3 and 4, while body condition score 3 did not differ from the body condition score 4. The difference in canon circumference is probably due to the body condition score 2 being larger and having a lot of muscle compared to body condition 4. The growth of animal body parts has different increases but the rate of growth is the same. Every increase in body weight there is a difference in the proportion of organs and tissues of muscle, bone and fat. All food substances in animal growth will be prioritized first for bone growth, muscle tissue and then fat [9].

4. CONCLUSION

Based on the results of the study, it was concluded that body condition scores 2, 3 and 4 had a very significant effect on body weight, carcass weight, carcass percentage, quadriceps circumference and canon circumference. Meanwhile, the hamstring circumference has a significant effect. The effect is not significant shown in the length of the quadriceps, the length of the hamstrings and the length of the canon bone.

Further research needs to be done with a larger number of livestock samples to get a more accurate body condition score.

ACKNOWLEDGMENTS

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