

Performances Body Dimensions of Bali Cattle on Slaughterhouse in Southeast Sulawesi

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Abstract. This study aims to determine the comparison of body measurements and body weight of male and female Bali cows. The research was at the Kendari City Slaughterhouse. Measuring 100 Bali cows consisting of 50 males and 50 females aged 1-3 years. Data were analyzed by Student's T-test. The results showed that the average male body weight was 191.30 kg and female 181.98 kg. The average body measurements of male and female Bali cows are body length (114.11 cm and 110.15 cm), gumba height (111.68 cm and 109.60 cm), chest circumference (149.30 cm and 146.15 cm), front canon bone circumference (14.89 cm and 14.75 cm), rear canon bone circumference (16.67 cm and 16.63 cm). There is no significant difference in linear body measurements in the two sexes of cattle ($p > 0.05$). It was concluded that the linear measurements of the bodies of Bali male and female cattle from traditional livestock breeding in Southeast Sulawesi were relatively uniform. But quantitatively the body measurements of male Bali cattle are relatively higher compared to female Bali cattle.

Keywords: Bali cattle, body dimensions, performances, sex

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1. Introduction

Southeast Sulawesi as a central of livestock development in eastern Indonesia has natural resources that are quite potential for the development of ruminant farms. The land area of Southeast Sulawesi is 38,067.7 km² ha, with an area of land used for plantations of 403,978 ha and grasslands of 69,399 ha, forests of 1,985,224 ha, hold of 91,025 ha of fields and buildings and yards of approximately 143,700 ha. From the area of land utilized, there is a high possibility for the development of beef cattle business in this area [1].

Most of the livestock business in Southeast Sulawesi are smallholder farms with the main commodity of Bali cattle which have an extensive maintenance system so that the results obtained are not optimal. This is shown from the daily body weight gain and beef slaughter weight that does not meet expectations [2]. Though body weight is closely related to the percentage of carcasses. Cattle with high weights are certain to have a high percentage of carcasses and meat production [3].

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Measurement of body weight of cattle is one of the things that is very important and needs to be known to determine the value of the livestock, such as meat production, selling prices, the purpose of selecting seed production, feed requirements and administering drugs with the right dosage [4]. Measurement of body weight is done by several methods including direct and indirect weighing methods with estimation through measurement of body parts including chest circumference, height, body length and bones. Muscle growth is followed by bone growth. Bone grows continuously with a relatively slow growth rate of the muscle relatively quickly so that the ratio between muscle and bone increases during growth according to the growth pattern of the carcass component [5] [6] [7].

There is a tendency that the muscle and bone growth of male cattle is higher than female cattle, and this is influenced by genetic and environmental factors. Environmental factors greatly affect the growth and development of Bali cattle both environmentally in terms of nutrition and physiology. Research on Bali cattle has been widely developed, but information about the growth of muscles and bones of Bali cattle is still not widely known. This research was conducted to examine the relationship between body measurements and body weight of Bali cattle on slaughterhouse at Kendari.

2. Materials and Methods

This research was conducted at the Slaughterhouse of Kendari City, Southeast Sulawesi Province. Observations and measurements using Bali cattle found in Kendari City Slaughterhouse as many as 100 heads consisting of 50 male Bali cattle and 50 female cattle with a range of age 1-3 years based on the condition of the teeth (Incisor). The tools used are 1000 kg scales, measuring tape, measuring sticks and writing instruments.

Data obtained directly from the field through weighing and measuring body parts. Determination of the location of research at the Slaughterhouse is done because it is central to slaughtering cows originating from the entire Southeast Sulawesi region so as to represent Bali cattle in this region. Besides that, Bali cattle can be weighed and have a stable cage.

The variables observed in this study were body weight, body measurements consisting of: chest circumference, body length, button height, and canon bone circumference. The data obtained were tabulated based on different sex classifications then analyzed using Student's T-Test with the following mathematical models:

$$S = \sqrt{\frac{(n_1-1)S^2_A + (n_2-1)S^2_B}{n_1 + n_2 - 2}} \quad (1)$$

$$t = \frac{\bar{X}_A - \bar{X}_B}{S \sqrt{\frac{1}{n_A} + \frac{1}{n_B}}} \quad (2)$$

Description: t = Statistical Value of two variables (male and female); $\bar{X}A$ = Average male treatment; $\bar{X}B$ = Average female treatment; S = Combined standard deviation; nA = Number of male treatment; nB = Number of female treatment

3. Results and Discussion

The results and discussion of the observations of the body dimensions of male and female Bali cattle from community farms in Southeast Sulawesi are described as follows.

3.1. Weight of Body

The weight data of male and female Bali cattle is presented in Table 1. The average body weight of male and female Bali cows was 191.32 kg and 181.97 kg. The results of the study are not much different from the results of Karno's research the average body weight of Bali Cattle with 1.5 years of age including males 144, 185.5, 195.87, 129.75, 176.5 with an average of 166.32 kg, and females 136.62, 172.62, 177.25, 129.5, 159.12 with an average of 155 kg, and the total number of bulls and 1.5-year-old cattle reaching an average of 160.66 [8]. While the average body weight of Bali cattle aged 2 years including males 136.5, 176, 183.75, 184.12, 131.25, with an average of 162.32 and females 138.62, 181.75, 183.25, 136.75, 171.75 with an average of 162.42, with a total of 2-year-old male and female Bali cattle reaching an average of 162.37. Then the next division between 1.5-year-old bulls with 2-year-old bulls, an average of 164, 32, and 1.5-year-old cows with 2-year-old cows, an average of 158.71. The number of categories from the sum of male and female cattle that are 1.5 years old and 2 years old with an overall total of 161.51 kg.

Table 1. Average Body Weight of Male and Female Bali Cows During the Study

Variable	Sex	
	Male	Female
Number of Sample (head)	50	50
Weight (kg)	191.32±9.56	181.97±9.09

* Analysis of t-test was not significant difference ($P>0.05$)

Based on the results of the Student T-Test showed that the average body weight between male and female of Bali cattle did not show a significantly different effect ($P>0.05$). But quantitatively the average weight of male Bali cattle is higher. This is due to the fact that Bali male cows have larger bones and muscles. The chest, shoulder height, shoulder width, and age have an influence on increasing body weight [9].

Chest circumference in Bali cattle is influenced by gender, age of livestock, environmental conditions such as the location of the height of the surface of the sea and the existing feed [10]. Increasing chest circumference with weight gain has a very close relationship so that the increase in circumference chest that can be used to predict weight gain [11].

The high body weight of bulls caused by a strong correlation between growth and species development could also cause differences in body weight [4] [12]. Male cattle usually grow faster and at the same age heavier than female Bali cattle [5] [7]. The influence of sex on all types of animals sometimes takes place quickly, slowly and even stopped long before the animal reaches a large body size because it can be influenced by genetic or environmental factors [6] [8]. Androgen hormones in male animals can stimulate and stimulate the growth of rapid growth at puberty partly due to the anabolic influence of proteins from androgens so that male animals can be larger than female animals [12].

Growth is a change in the shape or size of a livestock that can be expressed in length, volume or time [12] [13]. Growth can be assessed by increasing height, length, circumference size and body weight that occurs in a livestock. Cattle growth is weight gain and development of body parts. The process of growth in cows starts from fertilization, pregnancy, birth, and then goes through adolescence or puberty to maturity. Rapid growth occurs in the period of birth to weaning and puberty [14].

Growth and development of calves depends on genotype, sex, feed, and care. Livestock growth is usually expressed by changes in life weight, height or height change [3] [15]. The heavier the weight gain per day the better the growth. Growth is genetically restricted to the adult body. Bali cattle are usually the weight after the adult body occurs because of the popular accumulation of fat, fattening. Growth will decline after the age of puberty to adulthood to the age of selling. In mature cattle, the use of rations to increase body weight is no longer efficient. Therefore, in order to achieve higher economic efficiency it must be known when the right time for fattening and the right time to sell cattle. The growth of body weight of cattle is determined by various factors including the type of cow, sex, age, ration given, and technical maintenance [13].

The difference in growth rates between the sexes can be greater in accordance with increasing age so that it will affect other body measurements. Overall body growth is generally measured by increasing body weight [16]. Growth in body weight of cattle is determined by various factors including cow type, sex, age, ration provided, and technical maintenance [12] [17]. Body shape or in terms of weight gain are very useful for selection in livestock breeding as a guide in the performance of conditions on "grazing" or feedlot, although it is important that the closer to adult body weight gain is lower [18].

The results of this study indicate that the average body weight of bulls is relatively higher than that of female Bali cattle. This is in accordance research stating that bulls will grow faster or have higher body weight gain compared to female Bali cows [7]. The body weight gain of a 2-year-old female Bali cow is higher than the body weight of a 1.5-year-old female Bali cow. The weight gain of a 2-year-old female Bali cow is compared to that of a 1.5-year-old female, due to the influence of the feed and the local environment. The treatment carried out by the farmer provides

feed to the cows. This can be caused because at the age of 2 years (24 months) is the peak age of growth and after that growth gradually decreases. In addition, one of the differences in body weight can be influenced by the level of feed consumption where *ad libitum* feeding will increase feed consumption and will affect body weight. Parakkasi explains that some research results show that young animals need less food than older ones for each unit of body weight growth. One factor is the body weight of young animals [19].

3.2. Body Length, Button Height, and Chest Circumference

The average body length measurements, button height and chest circumference of Bali cattle are presented in Table 2. The mean values of body measurements (body length, button height, chest circumference), male and female, respectively are body length (114.15 cm and 110.16 cm), button height (111.70 cm and 109.62 cm), chest circumference (149.35 cm and 146.19 cm). In contrast to research that, chest circumference 192 cm, button height, 127 cm, and body length 120 cm. Weight of female Bali cattle, adults, about 260 kg, 165 cm chest circumference, 114 cm button height, and 103 cm body length [20].

Cattle body measurements can be used to estimate the body weight of a cow and are often also used as a technical parameter for determining cattle breeds [21]. Animal body size can describe the ability and good production of a livestock, body measurements include, body length, gumba height, chest circumference, chest height, chest width, and head index, the measurements the body needs to be known to know livestock productivity [9]. The formula known as school formula uses the circumference variable and the modification formula uses the circumference variable, and body length [7].

Tabel 2. Average Body Length, Button Height, and Chest Circumference (cm) During the Study

Variable	Sex	
	Male	Female
Number of Sample (head)	50	50
Body Length (cm)	114.15±3.42	110.16±3.30
Button Height (cm)	111.70±3.35	109.62±3.28
Chest Circumference (cm)	149.35±4.48	146.19±4.38

*Analysis of t-test on the same line is not significant difference ($P>0.05$)

Body measurements that are often used in estimating body weight or evaluating livestock productivity include height, chest circumference, and body length. Body measurements that can be measured in addition to body length and chest circumference include shoulder height, hip height, chest height, hip width, groin width, sitting bone width, groin length, chest circumference, and circumference of the lower limbs [22].

Reported the weight of adult Bali bulls, around 400 kg, chest circumference 192 cm, gumba height, 127 cm, and body length 140 cm. Weight of female Bali cattle, adult, around 260 kg, chest circumference 165 cm, gumba height 114 cm, and body length 120 cm [20]. The results study

stated that the body length of Bali bulls aged < 1 year 120 ± 86 cm and ages $> 1-2$ years 120.67 ± 0.81 cm. Furthermore, the measurement of chest circumference is 170.14 ± 1.35 cm and 170.53 for males and females 150.88 cm [23]. Fourie states in the chest, shoulder height, shoulder width, and age have an influence on body weight [24].

Student's T-Test showed that the average body length, height of hump, and chest circumference between male and female cows had no significant effect ($P > 0.05$). Quantitatively the average body length, height of hump and breast circumference of male Bali cows are higher. The high average body sizes of male Bali cows are due to the higher proportion of tissue in male Bali cows compared to female cows which has implications for increasing overall body measurements. That height, chest circumference, chest width, steering and so on are a combination of the weight and size of the cattle [17]. Body size can be used to estimate body and body weight and carcass weight, as well as to give an idea of the animal's body shape as a characteristic of a certain Bali cattle breed [4]. The high body measurements of livestock are also usually influenced by various factors, especially sex, food and environmental factors. The proportion of bone, meat and fat tissue will be affected by age, nationality, body weight, deep chest, chest circumference, and shoulder height [25].

Quantitative traits are properties that can be measured from animals that have degrees and properties that are observed or seen from the body of the animal itself such as body length, while body length measurements are carried out by stretching the measuring bar starting from the shoulder joint (humerus) to bone filter (tuber ischii) [21]. Shoulder height, measured from the highest point of the shoulder perpendicular to the ground using a measuring stick. Hip height, measured from the highest part of the hip perpendicular to the ground using a measuring stick. Chest circumference, measurement of the circumference of the chest is done by circling a measuring tape on the body of the animal right behind the front leg. Measuring tape must be tightened so that the measuring tape on the chest feels, and inside the chest, the distance between the highest point of the shoulder and the breastbone.

The growth potential of livestock is determined by genetics expressed in hormonal relationships in the body, this results in differences in growth rates and adult weight achieved [25]. 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 the difference in the amount of fat that has been stored by the body [27]. These differences will make the body composition or frame size of cattle differ. Kadarsih states that linear measurements of the body can be used in predicting cow productivity including body length, height, chest size [28].

The results of the assessment of livestock body measurements can provide an illustration of whether livestock that are kept growing well or not. That livestock body size can describe the

ability and good production of a livestock, body size measurements include, body length, gumba height, chest circumference, chest height, chest width, and head index [29].

3.3. Circumference of the front of the Canon bones, and the circumference of the back bones of the Canon Bali male and female cows

Student T-Test results show that the average circumference of the front and back canon bones between male and female cows has no effect significant ($P>0.05$). But quantitatively the average body weight of bulls is higher. This is due to the fact that Bali bulls have a larger skeleton. The average circumference of the front and back canon bones of male and female Bali cattle is presented in Table 3.

Table 3. Average Canon Bone Circumference and Rear Canon Bone Circumference of Male and Female Bali Cattle

Variable	Sex	
	Male	Female
Number of Sampel (head)	50	50
Circumference of the front of the Canon bones (cm)	14.91±0.45	14.77±0.44
Circumference of the back of the Canon bones (cm)	16.69±0.50	16.64±0.48

*Analysis of t-test on the same line is not significant difference ($P>0.05$)

The mean values of the circumference of the front and back canon bones of males and females (14.91 cm and 14.77 cm) and 16.69 cm and 16.64 cm respectively. The high value of front and back circumference of canon bones of Bali male cows compared to female Bali cows is due to the high body weight of male Bali cows, where the increase in body weight and increase in body measurements of cattle still have a close relationship with production capacity including body length, chest circumference and button shoulder height including canon bone circumference [13], states that overall body growth is the result of the growth of different body parts. Skeletons or bones grow quickly in a short time after livestock are born, after that followed growth of muscle and then fat. Bone growth and development will determine the size of the animal's body. Bone is formed in the prenatal and postnatal periods by a connective tissue. Bone growth has the slowest rate when compared to muscle growth and fat growth [27]. In cattle that experience early maturity such as Bali Cows or Indonesian local Cows, the inflection point has been reached for bone growth at weaning age so that the bone growth curve reaches a maximum faster than muscle and fat growth [5] [7] [13].

The main components of carcass composition in livestock consist of muscle, fat, and bone. Increasing the weight of one component will reduce the weight of the other components proportionally, in other words if an increase in one component occurs there will be a decrease in the other component. The three carcass components, muscle, fat, and bone will affect the carcass value both in terms of the quality of the carcass and the quantity of carcass produced [6]. Under conditions of growth the carcass component goes hand in hand with the sequence of bones

growing first, followed by muscle and fat. Bone components in carcasses continue to increase from the time cattle are born to the age of 5 months, then experience a decline until adulthood. Muscle components in carcasses have a maximum proportion at the age of 5-15 months and decrease when aged above 15 months. The fat component continues to increase at the age of 20 months and continues to increase with age. The fat component is stable at 40 to 45 months [6].

4. Conclusion

It was concluded that the average weight and body measurements of male and female Bali cattle did not show any significant differences. But quantitatively on all parameters observed weight and measurements of male Bali cattle are higher than female Bali cows.

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