Characteristics of body weight and body size of Bali cattle aged 0 - 8 weeks in Sub-district Landono, Konawe Selatan Regency

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Abstract. This study aimed to understand the characteristics of body weight and body size of cattle aged 0-8 weeks in Sub-district Landono, Konawe Selatan Regency. This research had been conducted for 8 weeks by using Bali cattle calves observed since the day they were given birth. Research variables consist of body weight, chest circumference, shoulder height, and body length. Result of the study showed that the average body weight of male Bali cattle calves aged 8 weeks was 57.90 kg and females was 52.50 kg, male chest circumferences is 82.60 cm and female is 80.35 cm, male shoulder height was 73.30 cm, while female was 70.90 cm, and males body length was 66.00 cm and females was 61.65 cm. It could be concluded that body weight and body linear size of cow calves (chest circumferences, shoulder height, and body length) aged 0-8 weeks is the quick growth acceleration phase. Keywords: Measurement, Bali cattle, growth.

1. Introduction
Cattle population in South-east Sulawesi Province is 331,958 heads, [1] which are most of the cattle are Bali cattle. Improvement of Bali cattle production is continuously developed including by increasing maintenance management calf and heifer by the farmer. Some of the benefits of Bali cattle are that it has high mortality [2], and can grow in a bad environment [3], and can persist in a high temperature [4].

The diversity of ruminant animals can be identified from phenotype characteristics, production, and molecular [5]. Phenotype diversity is observable parameters or directly visible such as height, weight, color, and body-color pattern, horn growth, and so on. Phenotypic diversity (quantitative characteristics) owned by every individual is strongly affected by the environment and controlled by many gene pairs[6].

Growth can be measured by measuring weight gain and body height of animals [7], and the whole body growth is generally measured by the increase of body weight, whereas body size can be estimated by measurement of shoulder height, body length, and chest circumferences. A combination of weight and body size is generally used as growth estimation.
2. Methodology

2.1 Location and Time of Research
This study was conducted from February to May 2017 located in Sub-district Landono, Konawe Selatan Regency.

2.2 Materials
Bali cattle calves used in this study were 30 heads aged 0 week. Tools used were digital scale capacity of 1.5 tons for Bali cattle calf, measuring stick to measure shoulder and hip height, while measuring tape was used to measure body length and chest circumferences of Bali cattle.

2.3 Observed Variables
Measurement of calves' body dimensions was conducted every 2 weeks since calves were given birth. Body dimension measurement was including chest circumferences, shoulder height, and body length.

a. Birth weight was obtained by weighing the calves less than 24 hours after given birth, whereas average daily gain (ADG) was obtained by using the formula as follows:
   \[\text{ADG (kg)} = \frac{\text{Final weight (kg)} - \text{Initial weight (kg)}}{\text{Observation period (days)}}\]

b. Chest circumference (CC) was measured by measuring chest circumferences/body exactly behind the scapula bone, going through the shoulder by using a measuring tape in cm units.

c. Shoulder Height (SH) was measured by measuring the highest length of shoulder going through behind the scapula bone upright to the ground by using a measuring stick in cm units.

d. Body Length (BL), horizontal length from the front edge of the shoulder joint to the hind edge of the ethmoid bone bundle by using a measuring stick in cm units.

2.4 Data Analysis
Obtained data were analyzed by using descriptively statistical analysis measuring the average, standard deviation, coefficient variation. Measurement of average and standard deviation was conducted by using a formula as follows [8]:

\[\bar{X} = \frac{1}{n} \sum_{i=1}^{n} X_i\]
\[S = \sqrt{\frac{\sum_{i=1}^{n} (X_i - \bar{X})^2}{n}}\]

\(\bar{X}\) = Average count  
\(S\) = Standard deviation  
\(n\) = Number of data  
\(X_i\) = Data values

Formula of coefficient variation according to formula as follows [9]:

\[\text{KV} = \frac{S}{\bar{X}} \times 100\%\]

\(\bar{X}\) = Average counts  
\(S\) = Standard deviation  
\(\text{CV}\) = Coefficient variation

3. Result and Discussion

3.1 Body Weight
Bodyweight of male and female Bali cattle aged 0 to 8 weeks were presented in Table 1.
Table 1. Body weight (kg) of Bali cattle based on different sex

| Age (week) | Male | Female |
|------------|------|--------|
|            | X±SD | CV (%) | X±SD | CV (%) |
| 0          | 15.30±1.89 | 12.34 | 13.00±1.89 | 14.55 |
| 1          | 19.80±2.10 | 10.59 | 17.35±2.18 | 12.58 |
| 2          | 24.20±2.53 | 10.45 | 21.60±2.50 | 11.58 |
| 3          | 29.00±2.67 | 9.20  | 25.95±2.74 | 10.57 |
| 4          | 34.00±2.71 | 7.96  | 30.40±2.89 | 9.51  |
| 5          | 39.50±2.99 | 7.57  | 35.05±3.27 | 9.32  |
| 6          | 45.30±3.47 | 7.65  | 40.50±3.68 | 9.08  |
| 7          | 51.60±3.98 | 7.71  | 46.30±4.13 | 8.92  |
| 8          | 57.90±4.53 | 7.83  | 52.50±4.45 | 8.48  |

Keterangan:
- X: Average
- SD: Standard deviation
- CV: Coefficient variation

Based on the observation in Table 1, the average body weight of male Bali cattle aged 8 weeks Bali was 57.90 kg with the coefficient variation (CV) 7.83% while female 52.50 kg with coefficient variation 8.48%. It showed that male calves have a higher weight than females. It was due to the male cattle has a higher growth hormone than females. In beef cattle, growth hormone and production efficiency were higher in males than female animals [10]. Moreover, there is a positive correlation between the calves that have higher birth weight tends to be male [11]. In addition, factors correlate and can affect the birth weight including parent breed, calves sex, pregnant period, age or parent parity, and feed during pregnancy [12].

Bodyweight of Bali cattle is varied enough in each area. Birth weight (0 weeks) of Bali cattle in South-east Sulawesi is 12 to 13 kg, East Nusa Tenggara 10.5 to 15 kg and Bali Province 16 to 18 kg [13]. Birth weight in this research both male and female was 15.30-13.00 kg. Furthermore, the birth weight of male calves is higher 16.6 kg than female 15.2 kg [14]. A different result of this research is due to the genetic and environmental factors because various characters in animals observed were caused by genetic factors and the environment [6].

3.2 Chest Circumferences

Result of chest circumferences of male and female Bali cattle aged 0 to 8 weeks in Sub-district Landois presented in Table 2. It showed that there is an average of chest circumferences of male Bali cattle aged 2 months (8 weeks) 82.60 cm with CV 2.63% while female cattle was 80.35 cm with CV 2.97%.

The growth of chest circumferences of Bali cattle was increasing every week (aged 0 to 8 weeks). Bali cattle aged 0 to 6 weeks experiences exponential growth [15]. The exponential curve of Bali cattle is started at age 3 months to age 7 to 8 months (puberty period) [16].
Chest circumferences of Bali cattle aged 0 to 8 weeks grow quickly, part of the animal body grow formerly is chest circumferences followed by abdomen circumferences, the lowers neck circumferences, and finally the upper neck circumferences [17]. Male calves of Bali cattle have a higher chest circumferences growth than female. Bali calves growth is affected by the hormone, which androgen hormone stimulates bone growth in male calves while estrogen hormone causes the closing of physical in female calves [18, 15]. Chest circumferences have the real rule in estimating body weight compared to other body sizes [19], and chest circumferences in most of the ruminant animals are the best way to estimate body weight [20]. Therefore it is usually used as one of the selection criteria.

### 3.3 Height of Shoulder

Result of observation of shoulder height of male and female Bali cattle age 0 to 8 weeks in Sub-district Landonosi presented in Table 3. It is found that the average shoulder height of Bali cattle age 2 months (8 weeks) for the male is 73.30 cm with CV 3.03%, while for the female is 70.90 cm with CV 3.03%.

The height of the shoulder of Bali cattle aged 8 weeks in this study is higher than the previous study found 68.20 cm [17]. The difference between individual performance and production is affected by genetic and environment [6]. In addition, the growth of Bali cattle and Madura cattle since they were given birth to 4 weeks of age have the height of shoulder 57.7 - 68.1 cm and 61.6 - 66.3 cm respectively [21]. Muscle and bone growth are mainly accumulated in leg bone, therefore, affect the shoulder height. Forelegs are more active to move when the calves suckle to their parents [16]. The shoulder height of calves aged 0 to 6 months grow quickly compared to the hip part [22].

### 3.4 Body Length

Results of observation of body length of both male and female Bali cattle age 0 to 8 weeks in Sub-district Landonosi are presented in Table 3. It is found that the average body length for Bali cattle age 2 months (8 weeks) in males is 66.00 cm with the CV 3.35%, while in the female is 61.65 cm with CV 4.38%.

### Table 2. Height of shoulder (cm) of Bali cattle based on different sex.

| Age (weeks) | Male | Female |
|-------------|------|--------|
|             | X±SD | CV (%) | X±SD | CV (%) |
| 0           | 62.00±1.56 | 2.52 | 59.00±1.59 | 2.69 |
| 1           | 63.30±1.49 | 2.36 | 60.10±1.59 | 2.64 |
| 2           | 64.60±1.78 | 2.75 | 61.5±1.42 | 2.33 |
| 3           | 65.70±1.70 | 2.59 | 62.75±1.41 | 2.25 |
| 4           | 67.30±1.57 | 2.33 | 64.30±1.56 | 2.43 |
| 5           | 68.40±1.26 | 1.85 | 65.85±1.66 | 2.53 |
| 6           | 69.70±0.95 | 1.36 | 67.25±1.65 | 2.45 |
| 7           | 70.40±3.72 | 5.28 | 69.00±1.86 | 2.70 |
| 8           | 73.30±0.95 | 1.29 | 70.90±2.15 | 3.03 |

X: Average  
SD: Standard deviation  
CV: Coefficient variation
In Table 3, it is showed that the body length of Bali cattle is longer than female because variation in an individual is due to the genetic variation and environment [23].

4. Conclusion

Bodyweight and body linear size of calves (chest circumferences, the height of the shoulder, and body length) aged 0 to 8 weeks is in a surge growth acceleration phase.

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### Table 3. Body Length(cm) of Bali cattle based on different sex.

| Age (Week) | Male | Female |
|-----------|------|--------|
|           | X±SD | KK (%) | X±SD | KK (%) |
| 0         | 56.70±1.16 | 2.04 | 53.60±1.43 | 2.67 |
| 1         | 57.70±1.16 | 2.01 | 54.55±1.57 | 2.88 |
| 2         | 59.00±1.15 | 1.96 | 55.10±1.62 | 2.94 |
| 3         | 60.20±1.32 | 2.19 | 56.05±1.82 | 3.25 |
| 4         | 61.40±1.65 | 2.68 | 56.90±2.05 | 3.60 |
| 5         | 62.10±2.02 | 3.26 | 57.90±2.20 | 3.80 |
| 6         | 63.40±2.27 | 3.58 | 59.15±2.41 | 4.08 |
| 7         | 64.70±2.31 | 3.57 | 60.25±2.43 | 4.03 |
| 8         | 66.00±2.21 | 3.35 | 61.65±2.70 | 4.38 |

Keterangan:

- X : Average
- SD : Standard deviation
- KK : Coefficient variation
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