

# Production Performances of Bali Cattle Reared at Different Altitudes in Belu District, East Nusa Tenggara, Indonesia

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**Abstract**— This research aims to analyze the production performances between Bali cattle which reared at high altitude and low altitude in Belu District, East Nusa Tenggara. The research was done through direct measurement of the cattle's performances and interview to the farmers. The observed variables include calves' birth weight, weaning weight and body weight of the Bali cows. The obtained data were then analyzed with independent *t*-test. The results showed that Bali calves reared at high altitude had higher body weight (16.22±1.63 kg for bulls and 14.68±2.07 kg for heifers) than reared at low altitude (13.82±1.74 kg for bulls and 12.62±1.86 kg for heifers). In accordance, Bali calves reared at high altitude also had higher body weight (115.55±22.48 kg for bulls and 104.83±18.39 kg for heifers) than reared at low altitude (95.03±29.83 kg for bulls and 94.28±15.02 kg for heifers). Furthermore, the similar results also shown in the observation of Bali cows' body weight, with cows aged 2-3 years, 3-4 years, and >4 years reared at high altitude were weighted at 163.42±35.66 kg, 228.39±25.97 kg and 240.83±28.10 kg, whereas at low altitude were weighted at 142.20±45.16 kg, 224.67±15.81 kg, and 226.60±22.74 kg, respectively. The research concluded that Bali cattle which reared at high altitude had higher production performances compared to the low altitude.

**Keywords**— Bali cattle, Birth weight, Cows weight, Weaning weight.

## I. INTRODUCTION

The development of Bali cattle in Belu district, Indonesia, showed a promising potential to improve the prosperity of local households. It is regarding that almost all households in Belu district, especially who lived in the rural area, raised livestock to provide additional income. Moreover, Bali cattle are indigenous germplasm in Indonesia, so that the rearing of the breed would be preserved to provides beneficial outcomes.

The Bali cattle have been distributed across Belu district as the breed is preferred by local farmers. The cattle are known to have several features, such as its capability to utilize high-fiber feeds like scrubs and agricultural wastes, had high fertility, good environmental adaptation, and good carcass percentage, while also could provide a workforce as well [1]. Those features thus made Bali cattle to be a superior commodity in East Nusa Tenggara.

The national projections to achieve animal-based protein sufficiency by improving on cattle rearing production would be achieved if farmers have taken supporting factors of cattle's growth, such as the calves' quality, the nutritional value of the feed and the environment into accounts [2]. Furthermore, the land altitudes where cattle were reared are also known to

contribute to the Bali cattle productivity [3]. In order to support the development of Bali cattle rearing in Belu district, the actual data and information of the cattle rearing are essential. Thus, an evaluation of Bali cattle's performances in Belu district should be done as an initial effort to improve the cattle productivities. This research aims to understand the performances of Bali cattle which are reared in Belu district at different land altitudes. The outcomes of this research are hoped to provide information about Bali cattle and would be a guidance for Bali cattle development plan in Belu district.

## II. MATERIALS AND METHODS

The research was done in two sub-districts, which were West Tasifeto sub-district for the Bali cattle reared at high altitude (>500 m.a.s.l.) and East Tasifeto sub-district for the Bali cattle reared at low altitude (<500 m.a.s.l.), in Belu district, East Nusa Tenggara, during October to December 2018. The research location was also based by the condition that both sub-districts had the highest Bali cattle population in each respective altitude. The data from the Department of Livestock and Animal Health in Belu district showed that 69,621 of Bali cattle were reared in the district, which 13,321 of Bali cattle were reared in East Tasifeto sub-district and 9,082 Bali cattle were reared in West Tasifeto sub-district.

### A. Materials

The sample of this research were 311 Bali cattle, which consisted of 125 Bali cows (divided into 3 groups, which were 2-3 years, 3-4 years and >4 years), 109 calves at weaning age (±365 days), and 77 newborn calves (39 bulls and 38 heifers). The interview was done to 50 active farmer groups and 9 governmental field inspectors who served in both sub-districts.

### B. Data Analysis

The production performances of Bali cattle were analyzed by *t*-test as follow [4]:

$$t = \frac{|XA - XB|}{\sqrt{\frac{(nA)(S^2A) + (nB)(S^2B)}{nA + nB} \times \left(\frac{1}{nA} + \frac{1}{nB}\right)}} \quad (1)$$

Description:

XA : Mean value of sample A, XB: Mean value of sample B.

nA : Total sample A data, nB: Total sample B data.

S2A : Sample A variance, S2B: Sample B variance.

The weaning weight was directly measured by using a measuring tape, then corrected by the calves' weight and its progenitor age correction factor, regarding that in the research area the calves were weaned after aged at 6-12 months. The weight correction was calculated by following [5] as follow:

$$BScorrected = \left( \frac{BB-BL}{age\ during\ weighing} \times 305 + BL \right) (FKUI)(FKJK) \quad (2)$$

$$BSTcorrected = \left( \frac{BB - BL}{age\ during\ weighing} \times 160 + BS305 \right) (FKUI)(FKJK) \quad (3)$$

Description:

- BScorrected : Corrected weight at weaning age
- BSTcorrected : Corrected weight at 365 days
- BB : Current body weight
- BL : Birthweight
- FKUI : Progenitor age correction factor
- FKJK : Sex correction factor

### III. RESULTS AND DISCUSSIONS

#### A. Birth Weight

The statistical analysis showed that Bali cattle which were reared in high altitude had higher birth weight than reared at low altitude ( $p < 0.05$ ). Furthermore, the higher bodyweight of the bulls over heifers showed that Bali bulls had better genetic potentials. The condition was caused by the androgen hormone activities in Bali bull, which caused higher nitrogen retention and resulted in faster body growth. The mean birth weight of Bali bulls and heifers at different land altitudes can be seen in Table I.

TABLE I. Mean birth weight of Bali calves at different land altitudes.

Location	Bulls (kg)	Heifers (kg)
West Tasifeto (>500 m.a.s.l)	16.22±1.63 <sup>a</sup>	14.68±2.07 <sup>a</sup>
East Tasifeto (<500 m.a.s.l)	13.82±1.74 <sup>b</sup>	12.62±1.86 <sup>b</sup>

Different superscripts indicate significant differences ( $p < 0.05$ )

The birth weight of Bali cattle in this research was higher than [6] which measured the birth weight of Bali cattle reared in Sumbawa and showed that the birth weight of the Bali cattle was 14.2±1.52 kg. However, research by [7] showed that the birth weight of Bali cattle reared with the extensive farming system in Bangli district showed a higher result, which was at 20.30±2.17 kg for bulls and 18.42±2.15 kg for heifers. Research by Purwanto [8] also showed a higher birth weight of Bali cattle, which were 60.83±1.64, 61 kg and 17±2.12 kg. Moreover, research [9] showed that the average birth weight of Bali cattle could reach 17.50±7.47 kg for bulls and 16.02±2.16 kg for heifers. The different results showed that the birth weight of Bali cattle could be affected by various factors, such as its genetic factors (breeds and progenies) and environmental factors (sex, calving periods, cows' age and weight, and feed). However, the different birth weight of the Bali calves was also allegedly caused by different measuring method which would be resulted in different accuracy.

#### B. Weaning Weight

The statistical analysis showed that different rearing altitudes affect Bali cattle's weaning weight ( $p < 0.05$ ), whether

for bulls or heifers. The results showed that Bali cattle which were reared at high altitude had better weaning weight than reared at low altitude. The corrected weight of Bali cattle at weaning age can be seen in Table II.

TABLE II. Corrected weight of Bali cattle at weaning age (±365 days).

Location	N	Mean body weight (kg)
West Tasifeto	28 Bulls	115.55±22.48 <sup>a</sup>
	31 Heifers	95.03±29.83 <sup>b</sup>
East Tasifeto	25 Bulls	104.83±18.39 <sup>a</sup>
	25 Heifers	94.28±15.02 <sup>b</sup>

Different superscripts indicate significant differences ( $p < 0.05$ )

The weaning weight of Bali cattle in this research is higher compared to research by Ngiso-Bhae [10], which showed that the average weaning weight of Bali cattle reared at high altitude was 73.77±20.28 kg, while at low altitude was 69.48±14.51 kg. The result of this research is in accordance with [11] which showed that the weaning weight of Bali bulls was higher than Bali heifers. Their research showed that the weaning weight of Bali bulls was 99.46±4.1 kg and 95.51±4.1 kg for Bali heifers, and added that the higher parities in Bali cattle contribute to the higher weaning weight. An observation of cattle's weaning weight would be important to support the rearing development plan, as weaning weight had a positive correlation with the weight gain of the cattle [12].

#### C. Cows Weight

The results of the cows' weight measurement showed that different rearing altitudes had a significant effect on the cows' weight ( $p < 0.05$ ). Similar with birth weight and weaning weight measurement, Bali cows which were reared at high altitude had better body weight than reared at low altitude. The Bali cows aged 2-3 years were weighted at 163.42±35.66 kg when reared at high altitude, and 142.20±45.16 kg when reared at low altitude. For Bali cows aged 3-4 years, the cows which reared at high altitude were weighted at 228.39±25.97 kg and 224.67±15.81 kg when reared at low altitude. Furthermore, Bali cows aged more than 4 years were weighted at 240.83 ±28.10 kg when reared at high altitude and 226.60±22.74 kg when reared at low altitude. The mean body weight of Bali cows in this research is presented in Table III.

TABLE III. Mean body weight of Bali cows.

Location	2-3 years	3-4 years	>4 years
West Tasifeto	163.42±35.66 <sup>a</sup>	228.39±25.97 <sup>a</sup>	240.83±28.10 <sup>a</sup>
East Tasifeto	142.20±45.16 <sup>b</sup>	224.67±15.81 <sup>b</sup>	226.60±22.74 <sup>b</sup>

Different superscripts indicate significant differences ( $p < 0.05$ )

The mean body weight of Bali cows aged more than 4 years in this research is higher than [13] which showed that the body weight of Bali cows was around 174.09±27.7 kg to 217.96±46.7 kg. However, research by Hartati [14] showed that the Bali cows which reared in BPTU Bali had higher body weight (246.51±79.93 kg). Moreover, research by Ngiso-Bhae [10] on Bali cows aged more than 4 years showed that the cows which reared at high altitude were weighted at 404.90±89.20 kg and 366.14±95.20 kg when reared at low altitude. The different Bali cows' body weight was caused by different rearing environment, which includes feed availability

and the rearing system.

#### IV. CONCLUSION

The research showed that the birth weight of Bali cattle reared at high altitude was higher ( $16.22 \pm 1.63$  kg for bulls and  $14.68 \pm 2.07$  kg for heifers) than reared at low altitude ( $13.82 \pm 1.74$  kg for bulls and  $12.62 \pm 1.86$  kg for heifers). Moreover, the weaning weight of Bali cattle reared at high altitude was also higher ( $115.55 \pm 22.48$  kg for bulls and  $104.83 \pm 18.39$  kg for heifers) than reared at low altitude ( $95.03 \pm 29.83$  kg for bulls and  $94.28 \pm 15.02$  kg for heifers). A similar result also shown in Bali cows, where the body weight of Bali cows reared at high altitude were higher ( $163.42 \pm 35.66$  kg at 2-3 years;  $228.39 \pm 25.97$  kg at 3-4 years; and  $240.83 \pm 28.10$  kg at more than 4 years) than reared at low altitude ( $142.20 \pm 45.16$  kg at 2-3 years;  $224.67 \pm 15.81$  kg at 3-4 years; and  $226,60 \pm 22,74$  kg at more than 4 years).

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