

Research Article



Calf Birth Weight, Onset of Estrus and Postpartum Estrogen Levels of Bali Cows Raised in the Highlands and Lowlands of Gianyar Regency, Bali

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Abstract | This study aims to determine the calf birth weight, the onset of estrus, and estrogen levels of postpartum Bali cows raised in the highlands (Payangan District) and in the lowlands (Sukawati District), Gianyar Regency, Bali. A total of 20 Bali cows were used in this study that have given birth twice. The experimental design used was a completely randomized design (CRD) with two treatments, each consisting of 10 replications. The results showed that the average calf birth weight in the highlands was 17.29 ± 0.93 kg, while in the lowlands was 16.46 ± 0.40 kg, statistically showing a significant difference ($p < 0.05$). The onset of postpartum estrus in less or equal to 3 months in the highlands was statistically higher (80%; $p < 0.05$) as compared to cows in the lowlands (20%). Estrogen levels at postpartum estrus was 502.84 ± 232.20 pg/ml and 272.95 ± 184.43 pg/ml in the highlands and lowlands respectively, showed statistically significant differences ($p < 0.05$). Increased postpartum estrogen levels that occurred every month in the two groups showed significant differences ($p < 0.05$). From the results of the study, it can be concluded that the Bali cattle raised in the highlands show better reproductive performance than those maintained in the lowlands.

Keywords | Lowlands, Highland, Calf birth weight, Estrogen, Bali cattle

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INTRODUCTION

Bali Cattle is one of Indonesian cattle and is expected to contribute significantly in the supply of animal protein and have the tendency to adapt harsh environment and are the most popular due to their high fertility rate (Handiwirawan and Subandriyo, 2004; Bugiwati, 2007).

Reproductive performance is one of the most important factors that directly affects the development of beef cattle farms. Reduced fertility in cattle can hinder economic exploitation (Suyadi *et al.*, 2014). Some factors that affect cattle reproductive performance are the biological, physical environment, and type of nutrition (Fleck *et al.*, 1980;

Amin, 2014). Malnutrition causes cows fail to express their estrus sign (Gauthier *et al.*, 1983) and reduces calf birth weight (Pemayun *et al.*, 2014). Proper nutrition also affects the appearance of first estrus in Bali cattle (Heryani *et al.*, 2019).

Problems found in the development of Bali cattle are related to the lack of optimal reproductive function. Postpartum anestrus causes long calving intervals that can usually be achieved with 365 days of beef (Brzaková *et al.*, 2016). Ronjari *et al.* (2007) reported that 33% cows has long calving interval i.e., 14 months due to decreased ovarian function, less development of follicles, decreased level of estrogen hormone, and nonappearance of estrus

signs (Hafez, 2000). Environmental factors such as heat stress can also prolong postpartum anestrus (Opsomer and de Kruif, 1999).

The environment is one of the factors affecting livestock breeding. The higher the sea level, the lower the average daily temperature. Conversely, lowlands are also characterized by high temperatures, high atmospheric pressure and oxygen, causing livestock to experience depression and affect the reproductive process of livestock (Iskandar and Faisal, 2011). Environmental or climatic factors, nutritional factors, and management factors are considered to be the main causes of poor animal health and production. They are subject to physiological changes when exposed to high temperatures and humidity (Beatty et al., 2006). The temperature and humidity index (THI) affect fertility after calving (Diaz et al., 2018). According to Soeharsono (1998), environmental factors such as temperature and humidity are the most important aspects of livestock production because they directly affect productivity. Environmental stressors affect the hormonal system and animal physiology (Bowa et al., 2014) and conception rates (Villa-ancera et al., 2011; Schüller et al., 2014). This study aims to determine the calf birth weight, the onset of estrus, and estrogen levels of postpartum Bali cows raised in the highlands and in the lowlands in Gianyar regency, Bali.

MATERIALS AND METHODS

ANIMALS

This study used 20 Bali cows from community's farm that has given birth twice. The study design used in this study was a complete randomized design (CRD) with two treatment groups consisting of 10 replicates each. Cattle were divided into two groups: a group of cattle raised in the highland at 750 m above sea level in Payangan district and a group of cattle raised in the lowland in Sukawati district of Gianyar province, Bali. The feed that is given in the highland is grass and pasture, while only the king grass is given in the lowland. The determination of calf birth weight was done by weighing calf shortly after birth (maximum 1 hour after birth).

DETERMINATION OF POSTPARTUM ESTRUS

The cows were observed twice a day (7-8 am and 5-6 pm) to determine postpartum Estrus. A cow is in estrus if a clear secretion appears from the genital tract (vagina) during the observation.

ESTROGEN LEVEL MEASUREMENT

Estrogen levels were measured from the serum collected from the jugular vein. Blood collected after the cow was determine in postpartum estrus stage. The collected blood (5 ml) was centrifuged to separate the serum and stored

in the refrigerator until testing for estrogen levels. The estrogen hormone level was determined by ELISA using a bovine estrogen ELISA kit (Catalog Number: EB0091; Wuhan Fine Biological Technology, China).

STATISTICAL ANALYSIS

Data were analyzed using the ANOVA test. Testing for calf birth weight was done by the T-test, while estrogen levels were done by variance test. Data processing was carried out by SPSS 20 program for windows.

RESULTS

CALF BIRTH WEIGHT

The results of the average calf birth weight were 17.28 ± 0.93 kg in Bali cattle that raised in mountainous areas and 16.46 ± 0.40 kg in Bali cattle that raised in the lowlands (Table 1).

Table 1: Average \pm SD calf birth weight of Bali cows.

Group	Repetition	Calf birth weight (Kg)
Highland	10	17.28 ± 0.93^a
Lowland	10	16.46 ± 0.40^b

Different superscripts in the same column show a significant difference in order of 5% ($P < 0.05$).

Table 1 shows that the average calves birth weight in the highlands are heavier than in the lowlands, and statistically show a significant difference ($p < 0.05$).

POSTPARTUM ESTRUS

The percentage of onset of postpartum estrus ≤ 3 months in Bali cattle raised in the highlands was 80% that is higher ($p < 0.05$) than Bali cattle in the lowlands, which only 20% (Figure 1).

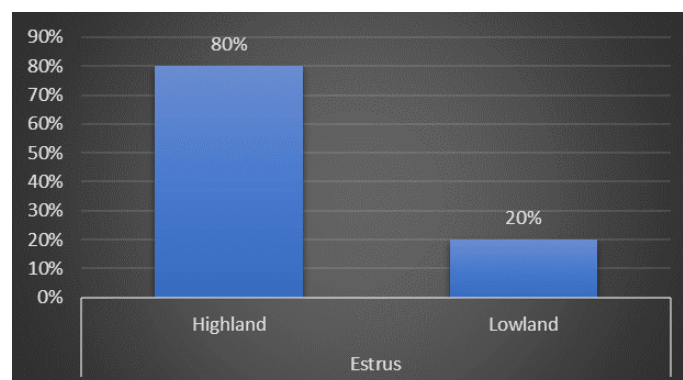


Figure 1: Postpartum Estrus percentages of Bali cows.

ESTROGEN LEVEL

The average estrogen level of postpartum Bali cattle raised in the highlands was 129.90 ± 28.73 , 196.48 ± 61.52 and 502.84 ± 232.20 pg/ml in 1st, 2nd and 3rd month respectively while in the lowland it was 106.11 ± 35.86 ,

139.45 ± 43.63 and 272.95 ± 184.43 pg/ml at 1st, 2nd, and 3rd month respectively after birth (Table 2).

Table 2: Average±SD estrogen levels in postpartum Bali cattle.

Group	Estrogen level (pg/ml)		
	1 st Month	2 nd Month	3 rd Month
Highlands	129.90±28.73 ^{aA}	196.48±61.52 ^{aA}	502.84±232.20 ^{bA}
Lowland	106.11±35.86 ^{aA}	139.45±43.63 ^{aA}	272.95±184.43 ^{bB}

Different superscripts in the same row and column show a real difference at the 5% order (P <0.05).

The monthly estrogen levels in both groups appear to occur mainly in the third month, showing a statistically significant increase (p <0.05). Increasing order of estrogen level was recognized with increase of time (month) regardless of altitude. The concentration of estrogen in Bali cattle raised in the highland three months after giving birth was statistically higher than Bali cattle raised in the lowland (p <0.05).

DISCUSSION

Fertility is a crucial factor in producing offspring. Postpartum anestrus is considered abnormal if it exceeds an average of 90 days (Ahuja and Montiel, 2005; Peter et al., 2009; Gitonga, 2010). The results of the study showed that the breeding ability of Bali cattle raised in the highland is superior to the Bali cattle raised in the lowland. Similar results were reported by Wira Pribadi et al. (2015), that the breeding efficiency of Bali cattle with similar cattle bred on the coast or lowland in terms of the number of days open (DO), pregnancy rate and calving interval. It was much lower than the cattle raised in mountainous or highland areas.

Calf birth weight in this study showed that Bali cattle raised in the highland were heavier than those raised in the lowland. These results reflect that feed availability is always sufficient in mountainous areas. According to Vermorel (1987) and Le Dividich et al. (1992), animals raised in high altitudes are reported to have higher feed intake. The same was reported that Bali cattle fed a high-quality diet could increase birth and weaning weight (Pemayun et al., 2014). According to Putra (2006), better feeding can increase the growth and activity of rumen microorganisms when decomposing feed. Therefore, these physiological conditions are relatively more rumen metabolites because parent animals can more efficiently utilize rumen fermentation products (rumen metabolites) as intermediate products of the digestion process due to their bioactivity. So that, the energy can efficiently utilize by livestock to increase calf birth weight, promotes postpartum physical condition, and increases weaning weight.

Van Niekerk (1982) reports that the breeding appearance of beef cattle after calving is highly dependent on the condition of the feed. Tropical beef cattle are usually highly reliant on natural pasture, and the crude protein content of the feed is often less than 7.5%. The same has been reported by Barden and Fuquay (1992), where low energy intake has been reported to increase the duration of postpartum estrus. The postpartum estrus of Bali cattle raised in high altitudes is more than 80% compared to only 20% lowland. The environment has a significant influence on the breeding process in lowland, where an average temperature of 31.3 °C causes stress. Stress destroys the endocrine system (Bova et al., 2014). Disruption of the endocrine system inhibits the release of the Gn-RH (Gonadotropin-releasing hormone) and FSH (Follicle-stimulating hormone), so the follicle does not develop, and results the low levels of estrogen and anestrus hormone (Beam and Butler, 1997; Hafez, 2000).

CONCLUSIONS

From the results it could be concluded that the high altitude had significant positive effect on reproductive performance (calf birth weight, onset of postpartum estrus and estrogen level) of Bali cows. Further research needs to be done on the body condition score (BCS) and underlying mechanisms on the reproductive performance of Bali cattle.

AUTHORS CONTRIBUTION

All authors contributed equally.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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