



(RESEARCH ARTICLE)



## The body dimensions and body weight gain on Bali calf and cows with different coat colors on the semi-intensive maintenance system in Kupang, Indonesia

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### Abstract

The aim of the study was determining body dimensions and body weight gain of Bali calf and cows with different coat colors in a semi-intensive maintenance system in Kupang district. The method applied was observation and measurement of Bali cows with sorrel, black and white coat colors. Bali cows are 4-7 years old. The result of the data measurements was analyzed by one way ANOVA using SPSS software version 25. The Average body length, chest circumference, shoulder height, hip width, head length, and head width of the Bali cows with different coat color in Kupang is 111.58 cm; 145.77 cm; 112.28 cm; 24.35cm; 36.28 cm; and 16.04 cm, respectively. While the average body dimensions of calf from Bali cows are 77.27 cm; 92.49 cm; 85.90cm; 25.65 cm; 12.813 cm; and 50.76 cm. The average body weight gain of Bali calves and cows was 173.68 g and 172.10 g/head/day. It was concluded that body color of Bali cattle in Kupang has no significant effect on body dimensions and body weight gain of Bali calves and cows. The body weight gain of Bali calves and cows with different coat colors which semi-intensively maintained was 173.68 g/head/day and 172.10 g/head/day.

**Keywords:** Calf; Bali Cows; Coat Color; Body Dimensions

### 1. Introduction

The female Bali cattle is red, the knees are white, the buttocks are shaped halfmoon, black tail tip, and there is a black eel stripe on the back, horns short, long and narrow head shape and slender neck [1,2]. However, Bali cows experience coat color deviations (*abnormal*) from sorrel coat color to Bali cattle black coat color (*Injin*), Bali cow has white coat and cows have spotted coat. *Injin* Bali cattle show characteristics since born, the female and male are black, while the white Bali cattle (*Albino*) has a white color due to the absence of pigment in the skin but have spiritual values that need to be maintained in Bali area [3].

Handiwirawan dan Subandriyo[4] stated that Bali cattle experience 17% deviation in the color of brick red/brown/black on the legs, Bali cattle spotted (0.6%) and *Injin* cattle (0.3%). Tabun [5] stated that the population Bali cow kept by breeders in Kupang Regency with sorrel coat colors (76.27%), black (14.41%), and white (1.69%). Coat color difference of Bali cows in Kupang is caused by the Melanocortin-1-receptor (MC1R) gene which are monomorphic (99%) and polymorphic (1%) [6, 7].

The color deviation of Bali cattle's coat is also possibly caused by the presence of *inbreeding* stress in cattle due to extensive livestock rearing systems. Praharani and Siaturi [8], *inbreeding* mating results in a more uniform generation

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and loss of heterozygosis in a population due to increased homogeneity of recessive genes. Gene recessive causes congenital disorders/defects, decreased livestock growth and productivity, genetic disorders, reproduction, survival, and overall functional suitability whole.

Abnormal female Bali cattle cannot be used as breeding cattle. The Bali cattle breed chosen based on high production traits and free from genetic defects according to the provisions. SNI 7652-4[1], the requirements for Bali cattle used as superior breeds must be: healthy and free from animal disease, free from all forms of physical defects and reproductive organs and do not have a genetically defective lineage.

The fact that, the provision of Bali cattle seeds in Kupang Regency-East Nusa Tenggara found that the breeders still used Bali cows with coat color abnormalities. The results of interviews with farmers showed that the ability to produce cattle coat color abnormalities are almost the same as sorrel Bali cows. Bali cattle abnormal can give birth every year and the growth of the calf is almost the same as calves from sorrel Bali cows [7]. It shows that cows with coat discoloration have the potential to be domesticated to produce seeds. However, there is no information about the production capability of abnormal Bali cows and their calves.

The productivity of Bali cows with different coat colors and calves can be measured production performance, namely body dimensions and body weight gain. What is performance Bali calves and cows with abnormal coat color have the same performance with sorrel Bali cow. Talib [9] stated that the weight 5-year-old Bali cattle in South Sulawesi, NTT, and Bali were: 280 kg; 295-478 kg; and 329 kg, respectively. Hartati [10] stated that the size of body length (BL), shoulder height (SH); and chest circumference (CC) of Bali cattle in Tabanan Regency, are: 120.48±38.08 cm; 111.15±4.99 cm; and 153.65± 10.59 cm, respectively. While in the district Bangli is 120.84±34.83 cm; 115.98±15.19 cm; and 156.74±18.48 cm, respectively. The morphological size of adult female cow at the Bali Province breeding center for each parameter BL, SH, and CC is: 119.6 cm; 114.4 cm; and 174.2cm, respectively, while in Bali Cattle Development (P3B, Bali) it is 118.7 cm; 113.8 cm; and 166.1 cm.

The utilization of abnormal Bali cows in producing calves as breeders or Bali feeder cattle in Kupang Regency, then the performance of Bali calves and cow abnormality is not known. Based on limited information on calf and brood performance Bali cattle are abnormal, then a study was conducted to determine body dimensions and body dimensions body weight gain of Bali calves and cows with different coat colors reared semi-intensively in Kupang Regency, Indonesia.

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## 2. Material and methods

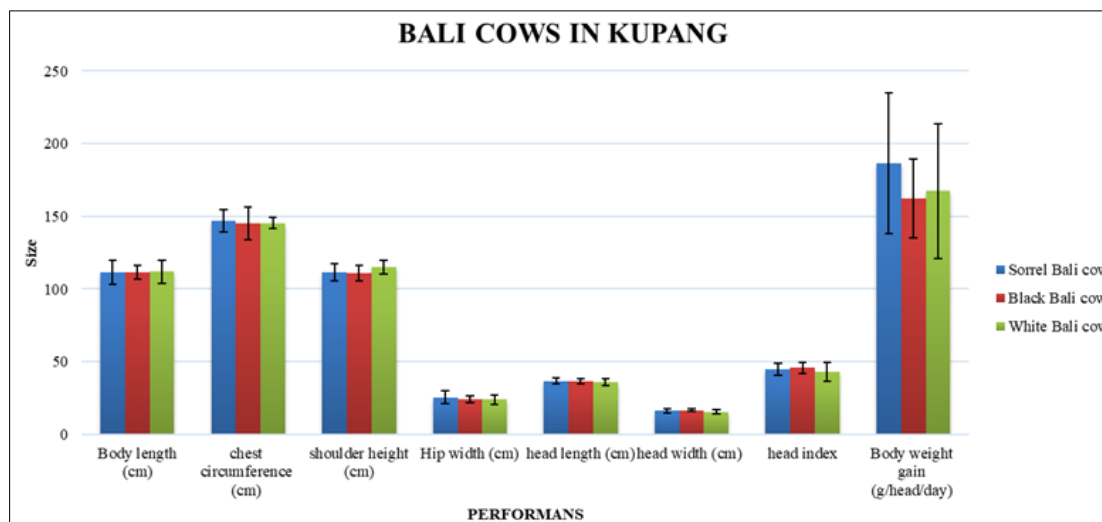
This research occurred for 10 months from October 2020 to July 2021 in Oeteta Village, Sulamu District, Kupang Regency, and Indonesia. The method applied were surveys and measurements. The measurement of body dimensions and body weight gain of Bali cows with different coat color. The age of Bali cattle was between 4-7 years and the calves were 2-7 months. The sample used in the study was 54 cows of Bali cattle with different coat color and 54 calves consisting of 33 calves and Bali cows with sorrel coat color (P1); 13 calves and Bali cows with black coat color (P2); 8 calves and Bali cows of white coat color (P3). Performance measurement were body dimensions (body length, chest circumference, shoulder height, hip width, head length, head width, head index) and daily body weight gain. The measurement results were analyzed using *one-way* ANOVA with SPSS version 26 software.

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## 3. Results and discussion

### 3.1. The Body dimensions and body weight gain of Bali cows

Bali cattle are sources of wealth and potential for livestock genetic resources Indonesia has different quantitative characteristics in each region. Body size is a reflection of growth in livestock by measuring weight gain which is expressed as weight gain and measures body dimensions. Productivity is the ability to produce livestock can be seen from the dimensions of the body [11], body weight and body weight gain [12]. Dimension measurement body size and body weight gain of Bali cows with different coat colors Kupang can be seen in the fig 1.



**Figure 1** Body dimension and body weight gain of Bali cows with different coat colors in Kupang

**Table 1** Performance of Bali cows with different coat colors

Performance	Bali cows with different coat colors		
	Sorrel	Black	White
	N = 33	N = 13	N = 8
Body length (cm)	111.47 <sup>a</sup> ± 8.45	111.53 <sup>a</sup> ± 4.69	111.75 <sup>a</sup> ± 7.74
Chest circumference (cm)	146.76 <sup>a</sup> ± 7.70	145.18 <sup>a</sup> ± 11.20	145.37 <sup>a</sup> ± 3.96
Shoulder height (cm)	111.26 <sup>a</sup> ± 5.83	110.71 <sup>a</sup> ± 5.27	114.87 <sup>a</sup> ± 4.61
Hip width (cm)	25.47 <sup>a</sup> ± 4.37	23.82 <sup>a</sup> ± 2.45	23.75 <sup>a</sup> ± 3.01
Head length (cm)	36.62 <sup>a</sup> ± 2.07	36.35 <sup>a</sup> ± 1.73	35.87 <sup>a</sup> ± 2.59
Head width (cm)	16.29 <sup>a</sup> ± 1.52	16.59 <sup>a</sup> ± 1.12	15.25 <sup>a</sup> ± 1.49
Head index	44.57 <sup>a</sup> ± 4.23	45.74 <sup>a</sup> ± 3.89	42.86 <sup>a</sup> ± 6.42
Body weight gain (g/head/days)	186.53 <sup>a</sup> ± 48.28	162.35 <sup>a</sup> ± 27.16	167.41 <sup>a</sup> ± 46.22

Note: <sup>a</sup> Values followed by the same superscript in the same line are not significantly different ( $P > 0.05$ )

The results of the analysis of variance from body length, chest circumference, shoulder height, hip width, head length, head width and head index in Bali cows with different coat color showed no significant difference ( $P > 0.05$ ). It shows that coat color does not have a significant effect on body dimensions. The similarity of body dimensions of Bali cows in Kupang is influenced by the similarity of the nation, maintenance and environmental management. Tabun [5] reported that Bali cow of different coat colors in Kupang have 100% genetic similarity with Bali cattle and bull. Hartati [10] stated that the body size of Bali cattle is also affected by the place of his life related to maintenance management. Syaiful [13] stated that the factors that affect the body size of cattle are: race, sex, age, feed, temperature and climate. Hikmaway [14] states that Bali cattle can be preserved as a natural livestock resource that has the ability to develop well in various environments in Indonesia, have high production and reproductive performance.

Average body length (BL), chest circumference (CC), shoulder height (SH), hip width (HW), head length (HL), head width (HW) of Bali cows with different coat colors in Kupang were 111.47 cm; 146.12 cm; 111.59 cm; 24.76 cm; 36.44 cm; and 16.23 cm, respectively. Tonbesi [15] stated that Bali cows aged over four years in Timor Regency North Central-NTT has body sizes, namely BL, CC, and SH (115.00 ± 7.16 cm; 148.75 ± 5.9 cm; and 106.75 ± 3.59 cm). Hartati [10] stated that the body dimension of Bali cows in Tabanan Regency for BL, SH, and CC were: 120.48 ± 38.08 cm; 111.15 ± 4.99 cm; and 153.65 ± 10.59 cm, while in Bangli Regency, Bali Province it was 120.84 ± 34.83 cm; 115.98 ± 15.19 cm; and 156.74 ± 18.48

cm. The morphological size of adult female cattle at the Bali Province Breeding Center for the parameters of BL, SH, and CC were: 119.6 cm; 114.4 cm; and 174.2 cm while in P3-Bali it was 118.7 cm; 113.8 cm; and 166.1 cm. Body dimensions of Bali cows in Jembrana Regency were 117.19 cm; 115.12 cm; and 165.43 cm [16].

Soekardono [17], deviant nature qualitative research in Sumbawa Island 0.5% and Lombok Island 5%. Quantitative properties of body weight  $152.05 \pm 35.40$  kg and shoulder height  $104.19 \pm 6.36$  cm. Ni'am [18] stated that Bali cattle in Pangkalpinang City, have body length measurements at cattle teeth change (Poel) 1, 2, 3, and 4 are: 98.5 cm; 99.9 cm; 105.4 cm; and 106.9 cm, respectively. Height by 106.6 cm; 106.8 cm, and 109.8 cm. Body weight on cattle teeth change (Poel) 1, 2, 3 and 4 sequentially is: 178.02 kg; 177.75 kg; 199.70 kg, and 211.45 kg, respectively.

Nutritional needs also affect the body dimensions of Bali cows. When at the beginning of the measurement, there was a shortage of feed with low quantity and quality. Results analysis of feed at the study site during the dry season with crude protein (CP) content and crude fiber (CF) of 3.3% and 35.84%, respectively. Whereas after the season it rains, with the growth of grass in the grazing location it changes in livestock growth due to the availability of feed in fresh conditions with a crude protein content of 9.55% and crude fiber 23.38%. Manu [19] states that pastures in NTT in October the content of crude protein and crude fiber of 2.71% and 69.22%, after the rain in December occurred improvement of feed quality, namely CP (6.18%) and CF (20.38%). It is further said that production, forage quality and the capacity of the West Timor savanna fluctuated according to season, the highest production at the beginning of the dry season, the best quality in the rainy season and lowest production and quality at the end of the dry season. At the end of the dry season livestock only consume 0.7-1.94% of forage dry matter (DM) from body weight so that they experience a shortage of 1.06-2.3% DM of feed from the need of 3% DM based on weight.

Fernandez and Rubianti [20] stated that the problem of protein deficiency in natural grasslands in NTT during the months of June to December which coincide with the dry season. Conditions like this will affect the productivity of livestock which cultivated, the occurrence of land resource degradation becomes large (over grazing) due to free grazing system. Bamualim [21] stated that the availability of feed and fluctuating livestock productivity related to seasons. Land productivity grazing, feeding patterns, and beef cattle productivity in Nusa Tenggara strongly affected by the long dry season. Bamualim and Wirdahayati [22], estimates that NTT has 4.1 million hectare of dry land, covering potential land for grazing an area of 2.1 million with a natural grazing capacity in NTT ranges from 1.4 to 2.8 heads/ha/year.

Based on daily body weight gain of Sorrel, black and white Bali cows showed no significant difference ( $P < 0.05$ ). Average body weight gain Bali cows have a different coat color of 176.97 g/head/day. Low body weight gain in the Bali cows caused by the livestock rearing system is carried out semi-intensive. The limited condition of feed in the pasture causes its growth very low. This is in accordance with [23] stated that the increase in daily body weight of seed Bali cow at BPT HMT Serading on the system semi-intensive maintenance of 0.11 kg/head/day. Ratnawaty [24] stated that giving concentrates to lactating mothers gave greater body weight gain of 0.34 kg/head/day compared to the calf given feed without concentrate (farmer's pattern) was 0.02 kg/head/day. The increase in body weight of Bali cattle is 400-600 g/head/day compared to farmer pattern fattening of 200-300 g/head/day by utilizing local feed (natural grass+Leucaena) and the use of probiotics (starbio). Average body weight gain of 0.38 kg/head/day by giving silage as a supplement to cows fattening in the dry season compared to control of 0.15 kg/head/day [24].

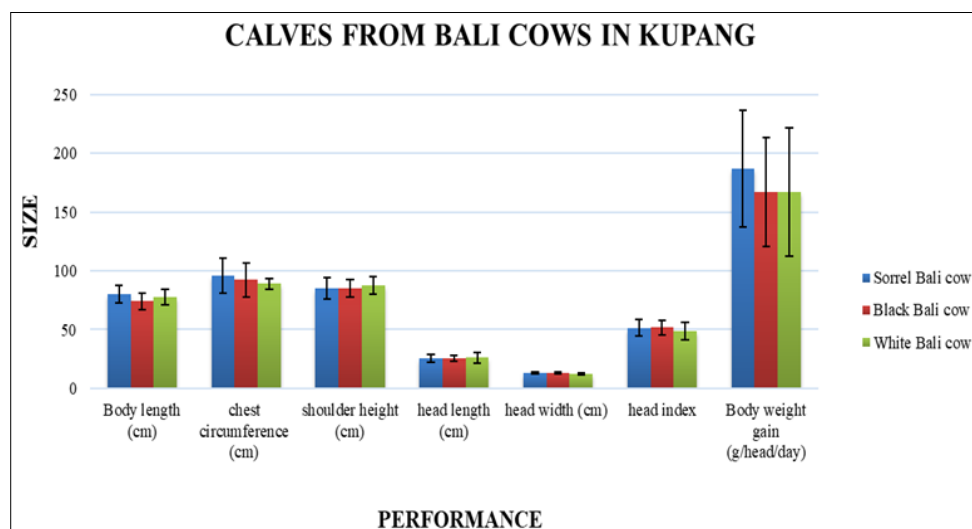
Livestock productivity performance is highly dependent on feed consumption. When cattle lack of feed leads to lack of energy, decreased growth or decreased weight. The increase in body weight of cows increases in the rainy season but decreases in the dry season. Wangi [25] stated that the average body weight of Bali cattle in the rainy season in the rice fields it is  $238.4 \pm 21.1$  kg and in the dry land is of  $231.2 \pm 21.2$  kg. Meanwhile, body weight in the dry season on dry land is  $212.8 \pm 18.3$  kg and in rice fields it is  $230.0 \pm 22.7$  kg. This shows that season and soil type affect parent body weight. In the rainy season it causes superior forage growth is better than in the dry season. Tana [26] reported that pastures in Oesao Village in the rainy season have the proportions of grass, legumes and weeds are 89.77%; 4.79%; and 5.44%. Forage production that can be consumed by livestock is 1,075.8 kg of fresh material/Ha, can accommodate 0.14 UT/Ha. Micke [27] content Australian native and introduced prairie proteins vary widely due to the high variability of rainfall. When the rainfall is high, the protein content of the desert grass can far exceed the NRC recommendations, however, during periods of low rainfall, pasture protein content is often 4-5%. During such times, protein supplementation is a major input cost for beef producers.

The efforts to increase the productivity of Bali cattle in improving growth the optimal level depends on the availability of feed and nutritional sources for livestock. Fernandez and Rubianti [20] stated that the average initial body weight of male calves is 92.5 kg at the end of the activity resulting in an average body weight of 103.3 kg/head or experienced an increase in daily body weight of 0.11 kg/head/day. In Bali cows in average initial body weight was 86.8 kg/head at the end of the observation to 101.4 kg/head or occurred increase in body weight by 0.14 kg/head/day. According [28], Bali

cattle weaning weight females in the highlands are higher than those in the hilly plains and successively low was  $89.61 \pm 8.9$  kg;  $85.18 \pm 13.16$  kg; and  $82.32 \pm 9.54$  kg

### 3.2. The Body dimensions and body weight gain of bali calves

Bali calves from Bali cows with different coat colors in Kupang aged 2-7 months with varying coat color. The growth of the calf will be faster if it is supported with the availability of quality feed. Syaiful [13] stated that calves at the age of 1-8 are a phase of maximum growth acceleration if they are supported by good nutrition, management and environment. The body dimensions of calves from bali cow with a different coat color in Kupang can be seen figure 2



**Figure 2** Body dimension and body weight gain in calves from bali cows with different coat colors in Kupang

**Table 2** Performans of calves Bali cows with different coat colors

Performans	Calves from Bali cows with different coat colors		
	Sorrel	Black	White
	N = 33	N = 13	N = 8
Body length (cm)	80.12 <sup>a</sup> ± 7.64	74.08 <sup>a</sup> ± 7.23	77.62 <sup>a</sup> ± 6.61
Chest circumference (cm)	96.12 <sup>a</sup> ± 14.89	92.23 <sup>a</sup> ± 14.17	89.12 <sup>a</sup> ± 4.73
Shoulder height (cm)	85.21 <sup>a</sup> ± 8.99	85.00 <sup>a</sup> ± 7.38	87.50 <sup>a</sup> ± 7.63
Head length (cm)	25.45 <sup>a</sup> ± 3.35	25.38 <sup>a</sup> ± 2.69	26.12 <sup>a</sup> ± 4.61
Head width (cm)	12.94 <sup>a</sup> ± 0.93	13.00 <sup>a</sup> ± 0.82	12.50 <sup>a</sup> ± 0.76
Head index (%)	51.59 <sup>a</sup> ± 7.12	51.73 <sup>a</sup> ± 6.21	48.96 <sup>a</sup> ± 7.52
Body weight gain (g/head/days)	186.743 <sup>a</sup> ± 49.56	167.17 <sup>a</sup> ± 46.67	167.11 <sup>a</sup> ± 54.49

Note: <sup>a</sup> Values followed by the same superscript in the same line are not significantly different ( $P > 0.05$ )

The results of the analysis of variance in body length, chest circumference, shoulder height, head length, head width and calf head index of calf from Bali cow with abnormalities coat color showed no significant difference ( $P > 0.05$ ). There is a similarity in the body dimensions of the calves that are kept in Kupang because it has genetic/national similarities and environment. Sampurna [11] stated that growth can be expressed in measurement of body dimensions influenced by internal factors, namely genetics, species, age and sexual hormones, and external factors such as feed and the environment.

The body dimensions can be influenced by the availability of feed as a source of nutrition for cattle. The availability of feed in pastures is limited and its quality is low therefore it causes the body dimensions of Bali cattle calves in Kupang show significant differences which are not real. Efforts to increase growth can be done by improving and supplementary feeding to the mother during pregnancy, but the feeding the addition did not have a significant effect on the body dimensions of the calf. This is in accordance with [29] stated that supplementary feeding to Bali cows at 6 months during pregnancy compared to mothers who did not give additional feed did not have a significant effect on the dimensions the body length of the calf was  $50.88 \pm 0.64$  cm and  $50.25 \pm 0.70$  cm.

The calf's body is influenced by the dimensions of the length of the parent, the length of the head, ears, neck, body, and tail [30]. Adiwiranti [31], which states that giving 0.5% rice bran with a protein content of 11.03% had a significant effect on growth of body dimensions of Java cattle, which can increase body length up to 0.09 cm. Jelantik [32] stated that calf feed supplementation of Bali calf in level 2 and 3% of the calf's weight can reduce the calf mortality rate from 17.9% to 6.1%. Feed supplementation significantly and linearly can increase the increase daily body weight of calves. However, milk production and weight loss of cows are not affected by calf supplementation. According [33], feeding supplementation of 2-3% of live weight Bali cattle in West Timor on the island of Timor can be increased in body length, chest circumference and height, respectively 0.08; 0.98 and 0.14 cm/head/day.

The average body weight gain of calf from Bali cow with different coat color by 176.97 g/head/day with a range between 167.11-186.7 g/head/day. The results of analysis of variance for body weight gain of Bali cattle calf from Bali cows with different coat colors shows no significantly different ( $P > 0.05$ ). This shows that the difference coat color in Bali cows did not have a significant effect on the body weight gain of the Bali calf. However, the growth of the Bali cow calf, the one with black and white coat color, have rather similar growth to Bali cattle mother with reddish brown color because of the genetic similarity and the environment. Calf growth is getting faster if it is supported by availability quality feed. Syaiful [13] suggested that Bali calves aged 1-8 months, the calf growth will be maximal if it is supported by nutrition, management and maintenance good environment.

The availability of feed as a source of nutrition for calves greatly affects the calf growth. The increase in growth was obtained by improving the composition of the feed, because the feed contains feed substances in sufficient and balanced quantities. Seeds Genetically good cows are only able to produce optimally if they are fed in sufficient quantities and meet nutritional requirements. This is due to the limited amount and quality of feed consumed. Performance livestock productivity is highly dependent on feed consumption. When cattle are short feed causes a lack of energy, decreased growth or even decreased body weight [25]. Bamualim and Wirdahayati [22] reported that in during the dry season, calves aged less than one year experience weight loss of 0.15-0.22 kg/head/day and young steers 0.34-0.35 kg/head/day. At the end of the season drought, bulls and mature cattle may experience even more weight lost body weight of 0.42-0.52 kg/head/day.

The growth of calves from Bali cows with different coat colors in Kupang is very low compared to the study conducted by [34] that the average daily body weight gain of calves from Bali cow with body weight of 150-250 kg is 0.73 kg and Bali cows with body weight of 251-300 kg are 0.87 kg. Dahlanuddin [35] stated that the growth of Bali cattle calves in the village of Tandek-Lombok that received Sesbania supplementation was a male calf of  $0.38 \pm 0.02$  kg/day and female calves  $0.32 \pm 0.02$  kg/day. While the calf that reared with a traditional management system of  $0.20 \pm 0.02$  kg/day and females of  $0.22 \pm 0.02$  kg/day. Nurhayu [36] stated that the provision of wafer rations complete (10% field grass; 20% rice straw; 70% concentrate feed) in Bali cattle calves gave an increase body weight gain is 272.50 g/head/day while the calves given grass feed has a body weight gain of 105 g/head/day. Pasambe dan Nurhayu [37] supplementary feeding of rice bran and tofu to Bali cows can increase calf body weight gain by 0.127 kg/head/day compared to feeding grass of 0.015 kg/head/day.

Seasonal factors are also very closely related to the availability of forage, where calves after weaning in the wet season tend to reach their annual weight heavier because of the presence of sufficient forage [38]. Amiano [39] stated that the average daily weight gain of males and female calves from birth to weaning in wet peat lands were lower than on dry peat lands. The body weight gain of female calves in wet peatlands ( $0.35 \pm 0.06$  kg/day) is lower than female calves kept on dry peat land ( $0.4 \pm 0.06$  kg/day). Fernandez and Rubianti [20] stated that feeding concentrates can increased daily body weight of male calves by 0.11 kg/head/day and female calves of 0.14 kg/head/day. Ni'am [18] stated that the body weight of Bali cattle calves in Pangkalpinang City at 1, 2, 3, and 4 teeth changes, were: 178.02 kg; 177.75 kg; 199.70 kg and 211.45 kg, respectively.

#### 4. Conclusion

The body color in Bali cows in Kupang did not have a significant effect on body dimensions and body weight gain of Bali calves and cows. The body weight gain of Bali calves and cows with different coat color reared semi-intensively in Kupang of 173.68 g/head/day and 172.10 g/head/day.

#### Compliance with ethical standards

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##### *Disclosure of conflict of interest*

All authors have read and agreed to send this manuscript to GSCBPS. All of the authors state that this research was carried out in the absence of commercial or financial relationships that could create a conflict of interest.

##### *Statement of ethical approval*

All procedures performed in experiments involving experimental animals were approved by the Ethics Commission of the Faculty of Veterinary Medicine, Udayana University, Denpasar-Bali.

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