

## THE EFFECT OF ALTITUDE ON MORPHOMETRICS OF BALI CATTLE IN THE BALI PROVINCE, INDONESIA

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### ABSTRACT

Bali cattle are native to Indonesia, have various advantages, including high fertility, and adapt to various environments. To maintain genetic quality are needed that have good morphometric. Morphometric development is influenced by the environment, including altitude. The material of use 200 head Bali cattle age over 2 years. This Place Highland (Kintamani District, Bangli Regency) with an altitude of 1700m, temperature of 17-20°C and humidity of 94%. Lowland (Gianyar Regency) 8m above sea level, temperature 29-31°C, and humidity 80% and this Time This research strated from January - February 2020. The method used has several steps in between manual measurment. Manual measurement of livestock is carried out using measuring sticks and measuring tape. Digital Measurement, Digital image capture is done using a digital SLR (DSLR) camera with a resolution of 18 Mp, focal length 18 mm, f/ 3.5-5.6 lens aperture range, ISO Range 100-6400, range Shutter Speed. The digital image analysis was carried out at the Large Laboratorium of Meat, Draught, and Companion Animals, Faculty of Animal Science, Gadjah Mada University. Measurement of digital image data is done using Image J software. Application Stage and Data were analyzed using student's test with two ways (multiple samples) to compare between manual and digital measurement. Morphometric measured by wither height, body length, chest circumference, chest depth, Hip height, hest width and Hip widht. The results showed that highland Bali cattle's morphometric was better ( $P < 0.05$ ) than the lowlands. Wither height  $112.68 \pm 4.62$  cm vs.  $102.04 \pm 3.73$  cm, body length  $110.61 \pm 7.54$  cm vs.  $102.68 \pm 5.55$  cm, chest circumference  $143.35 \pm 13.10$  cm vs.  $125.20 \pm 5.57$  cm, Hip height  $109.35 \pm 7.18$  cm vs.  $105.40 \pm 8.21$ , chest widht  $29.95 \pm 4.45$  cm vs.  $28.37 \pm 5.48$ , chest depth  $57.10 \pm 3.53$  cm vs.  $55.34 \pm 3.15$  cm and Hip width  $34.36 \pm 5.42$  cm vs.  $30.95 \pm 2.11$  cm. It concluded that altitude influences Bali cattle morphometric so that it is good to be the source of Bali cattle breeding.

Key words: Bali Cattle, Bali Province, Altitude, Morphometric

### INTRODUCTION

Bali cattle (*Bos sondaicus*) are native Indonesian cattle that contribute to meeting the national demand for meat. Bali cattle are one of the types of cattle that are important for livestock and contribute to the development of the livestock industry in Indonesia. These cattle have spread throughout Indonesia and entered by smallholder breeders who are generally small-scale businesses (Thalib, 2002). Bali cattle are the dominant breed in most of the eastern islands. The three main focuses of the Bali cattle population are South Sulawesi, and West Nusa Tenggara and instruction now exceeds that of Bali. Bali cattle can survive in all environmental conditions (Hikmawaty et al., 2014). The province of Bali, with an area of 5.780.06 km<sup>2</sup>, is geographically located in a location in the north-south 08°03' - 08°50' south latitude and in the east-west between 114°25' - 115°42' east longitude. Based on this geographical location, Bali Province has a tropical climate like other parts of Indonesia. The average temperature ranges from 24°C-26°C, maximum temperature 32.9°C, and minimum 24.2°C, but this is very rare. Humidity ranges from 70-84% and will increase the height of a place. One of the highlands of Bali Island is in Kintamani with an altitude of 1700 m, a temperature of 17°C - 20°C, and humidity of 94%. The lowlands are in Gianyar with an altitude of 80m, a temperature of 29°C - 31°C, and a humidity of 80% (BPS, 2018). Morphometric is a quantitative animal measured based on bone anatomy. Morphometric characters indicate an important framework development in beef cattle selection and breeding programs (Bene et al., 2007). Body size is often used for growth. The first indicator of growth is important, but cannot be used to express the body composition of livestock (Fourie et al., 2002). The morphometric approach is used to study genetic relationships so that measurements are made of body weight and body size. It is possible to use data methods to use method preparation methods (Brahmantyo et al., 2003; Salamena et al., 2007). Conventional morphometric measurements according to Marcus (1990), are carried out by measuring direct parameters of the livestock body such as height, body length, chest height, hip height, etc. using a ruler, measuring stick or measuring tape about the bony prominence (*tuberosity* or *processus*) or joints (*articulation*). Bewley et al. (2008) stated that the reference bone protrusion can also be used to determine the condition value of livestock. Manual measurements can provide several obstacles, including causing livestock to be stressed more easily, the measurement being less accurate because livestock moves too much and can even pose a risk of livestock aggressiveness that causes researchers to be injured by livestock attacks. By knowing the morphometric

characteristics of livestock, it can describe the production characteristics of these animals, such as the characteristics of the hips height to describe the level of maturity, and the width of the hips can describe the width of the pelvic space which is useful in reproductive characteristics. The length of the front and back motion tools and the angle of the bones give a picture of the cattle's agility in moving. It can be concluded that the altitude of the location has an influence on the morphometry of Bali cattle, so it is good to determine the location of the source of the Bali cattle breed.

## **MATERIALS AND METHODS**

The material of use 200 head Bali cattle age over 2 years. The equipment is Measuring Tape, Camera, measuring stick, Notebook, Livestock scale, Thermohygrometer This Place Highland (Kintamani District, Bangli Regency) with an altitude of 1700m, temperature of 17-20°C and humidity of 94%. Lowland (Gianyar Regency) 8m above sea level, temperature 29-31°C, and humidity 80% and this Time This research strated from January - February 2020. The method used has several steps in between manual measurement. Manual measurement of livestock is carried out using measuring sticks and measuring tape. Digital Measurement,. The digital image analysis was carried out at the Large Laboratorium of Meat, Draught, and Companion Animals. Fakultas of Animal Science, Gadjah Mada University. Measurement of digital image data is done using Image J software. Application Stage and Data were analyzed using student's test with two ways (multiple samples) to compare between manual and digital measurement.

## **DIGITAL MEASURMENT**

Digital image capture is done using a digital SLR (DSLR) camera with a resolution of 18 Mp, focal length 18–55 mm, f / 3.5–5.6 lens aperture range, ISO Range 100–6400, range Shutter Speed. Digital image capture is carried out at a full distance, that is, the distance has taken without zoom so that the full livestock image is obtained on the screen display, then a distance of 1.5 times the full distance and 2 times the full distance is taken. The main focus point of the camera is taken at the diagonal meeting of the body, which is the meeting between the diagonal of the base of the tail - the tips of the front legs with the hump - the ends of the hind legs (Bramada, 2016). The comparison used is a measuring stick that is placed linearly in the plane of the cow horizontally and can be placed behind or in front of the cattle. The technique of taking digital images with the observed parameters is macro parameters, namely in the chest, height, and body length. This third parameter is the main parameter that determines growth in beef cattle (Berg & Butterfield 1976). The analysis of digital photos was carried out using the Image J program. Image J was chosen as software for digital measurements because it has several advantages, namely: Image J software can be downloaded for free, the file size is relatively small, easy use, and is relatively compatible with several types of laptops. The measurement method using Image J starts by opening the digital image file that you want to measure. The next step is to determine the scale calibration by drawing a line on the measuring stick until it reaches 100 cm on the measuring stick. The line length is calibrated on a scale of 100 cm in the program. Measurement of morphometric parameters can only be carried out after calibration by drawing a line at the parameter boundary then the measurement results can be found.

## **MORPHOMETRIC MEASUREMENT**

Manual livestock measurement is done with measuring sticks and measuring tape. The research was carried out in two stages, namely the testing phase and the application stage. The testing phase is carried out to measure the level of accuracy of metric measurement measurements using digital images of manual measurements. This stage is carried out by measuring as many as 100 Bali cattle in the highlands and 100 Bali cattle in the lowlands with manual measurements and compared with measurements using digital images.

## **TESTING PHASE**

The results of the comparison test between the manual morphometric measurement method and the digital image processing method show that the body morphometric measurements between manual methods and digital image analysis do not show a real difference, but the use of DSLR cameras has a lower level of data diversity seen from the standard deviation. of measurement compared to manual measurement. The results of morphometric measurements using digital and manual images are presented in Table 1. This can be a reference that the morphometric measurement method of the livestock body using digital image analysis can be done to replace the manual measurement method. Taking digital images at different distances also did not make a real difference.

**Table 1. Comparison of digital and manual morphometric measurement values**

Parameter	Measurement	
	Digital	Manual
Full size (cm)		
Body length	103.97±0.87	103.00±2.68
Chest circumference	135.34±10.08	135.34±10.11
Chest depth	55.78±0.95	55.50±1.22
Half Full		
Body length	104.27±0.93	103.00±2.68
Chest circumference	136.34±3.63	135.34±10.11
Chest depth	56.49±1.03	55.50±1.22
2 full		
Body length	103.48±1.51	103.00±2.68
Chest circumference	134.18±9.14	135.34±10.11
Chest depth	54.44±1.00	55.50±1.22

This test is conducted to determine the farthest point of digital image retrieval that is still capable of producing accurate data. digital image retrieval can be done at a farther distance so that it does not endanger researchers in data retrieval. Furthermore, this technique will be tested in more detailed parameter measurements at the applicable stage. At this stage, the morphometric performance of Bali cattle in the highlands and lowlands will be compared.

#### APPLICATION STAGE

The application stage is carried out to determine the application of the morphometric measurement method using digital image analysis. At the application stage, the morphometric performance of the livestock will be observed in more detail, starting from the general performance, the foreground, rear motion equipment, to the body axis. The results of morphometric measurements on Bali cattle in the highlands and lowlands are presented in Table 2.

**Table 2. Comparison of the morphometric performance of Highland and Lowland Bali cattle**

Variable	Altitude	
	Highlands	Lowlands
Vital size of the body (cm)		
Body length	110.61 ± 7.54 <sup>a</sup>	102.68 ± 5.55 <sup>b</sup>
Wither height	112.68 ± 4.62 <sup>a</sup>	102.04 ± 3.73 <sup>b</sup>
Chest depth	57.10 ± 3.53	55.34 ± 3.15
Chest circumference	143.35 ± 13.10 <sup>a</sup>	125.20 ± 5.57 <sup>b</sup>
Hip Height	109.35 ± 7.18 <sup>a</sup>	105.40±8.21 <sup>b</sup>
Chest width	29.95 ± 4.45	28.37±5.48
Hip width	34.36±5.42 <sup>a</sup>	30.95 ± 2.11 <sup>b</sup>

explanation:

<sup>ab</sup> : different superscripts on the same line indicate a marked difference (P<0.05)

Based on Table 2, it can be seen that upland Bali cattle have greater body length, wither height, chest depth, chest circumference, hip height, chest width, and hip width (P<0.05) than lowland Bali cattle. The availability of feed in the rainy season in the highlands is sufficient for the growth of Bali cattle. during the dry season, altitude affects the body length of the Bali cattle. In adult Bali cattle, the measurement results are minimal and maximum for body length and height livestock body 111 cm- 145cm and 116 cm-160 cm The air temperature in these two areas is above the comfort zone for tropical livestock, especially during the day, so that the energy obtained from feed is used to relieve stress due to environmental temperature, and according to (Amir, 2010) the comfort zone for tropical livestock ranges from 10-27°C (Puja et al., 2013).

The chest circumference of the highland Bali cattle was greater (P<0.05) than the lowland. The height of the place affects the chest circumference of Bali Cattle. These results indicate that the humidity in the highlands is 94% affecting the chest circumference. High humidity can increase heat stress in cattle (Mader et al.,2006). Moisture can increase vapor pressure and inhibit the evaporation of body skin in the process of releasing body heat through sweat. Stress due to humidity only affects the chest circumference growth of Bali Cattle, while height is not affected because height growth has been reached first. Height growth occurs first, then chest circumference growth, as shown in research (Syawal et al.,2013) which reports that the order of growth in body dimensions based on Gompertz's analysis is shoulder height, chest width, chest circumference, and finally body length. chest circumference is a feature of size and in the chest as a feature of shape in Bali cattle (Mahmudi,2019). The difference in size and

shape of upland and lowland Bali cattle is probably due to differences in genetic factors and maintenance management. This is by the statement (Gunawan et al., 2008) suggesting that in addition to genetic factors, differences in body size are caused by environmental differences, including maintenance management. Various kinds of morphometric measurements have an important role in identifying various breeds of cattle, both among a breed of cattle and among cattle breeds (Yakubu, 2010). Morphometric measurements were carried out to determine the characteristics of the animal race.

In conclusion, the use of digital image analysis in livestock morphometric measurement methods can be used in scientific research with good data accuracy and can provide more complete and detailed data regarding livestock performance. Bali cattle morphometry in the highlands is higher than the lowlands. Several factors influence including Genetics, Environment, and Vegetation. The height affects the morphometry of Bali cattle, so it is good to be used as a source of Bali cattle breeding.

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