The Effect of Season and Birth Weight on Weaning Weight and Linear Body Measurements of Madura Cattle in BPTU-HPT Pelaihari, South Kalimantan

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ABSTRACT
The aim of the research was to determine the effect of the season and the birth weight of Madura cattle on weaning weight and linear body measurements of Madura cattle. The research material consisted of 128 Madura cattle located at the BPTU-HPT Pelaihari, South Kalimantan. The research method used a case study approach with direct field observations. The research variables included the season in Pelaihari, South Kalimantan, birth weight of cattle, weaning weight of cattle and linear body measurements. Data were analyzed using correlation, simple linear regression analysis, and t-test. The research indicated that the birth weight of cattle had a highly significant relationship ($p < 0.01$) with weaning weight. The linear regression equation between birth weight and weaning weight was represented as $Y = 35.05 + 4.44X$ with a correlation coefficient of 0.53. The t-test results indicated that birth weight (BW), Body Length (BL), Shoulder Height (SH) of male and female Madura cattle differed significantly, while Chest Girth (CG) did not differ significantly. The t-test results also showed that BW, BL, CG at the weaning age of male and female Madura cattle did not differ significantly, but SH differed significantly. Birth weight, body length, shoulder height, and chest girth of calves born in the rainy and dry seasons did not differ significantly, while there was a significant difference in the shoulder height of Madura cattle at the weaning age. In conclusion, the season and birth weight did not significantly affect body weight, body length, chest girth, and linear body measurements. However, they did significantly affect shoulder height at the weaning age of Madura cattle.

Keywords: *Madura Cattle, Season, Body Weight, Linear Body Measurements.*

1. INTRODUCTION

As the population in Indonesia increases, it will lead to an increase in the amount of consumption of Indonesian people, including an increase in the amount of meat consumption nationally. Based on data from the Ministry of Agriculture [1], in 2018 the amount of local beef production was 403,668 tons and the amount of beef consumption needed was 663,290 tons. In 2019, the amount of local beef production was 429,412 tons and the amount of beef consumption needed was 686,270 tons.

Based on these data, the fulfillment of meat consumption in Indonesia is still not optimum because the meat production is lower than the meat consumption needs. One of the efforts that can be taken to increase meat and calf production is to increase the number of beef cattle and the genetic quality of livestock. This aspect is important in order to establish a productive domestic beef cattle population that is able to meet domestic meat demand. Such a population will be formed when there are efforts to develop beef cattle breeding in a sustainable manner supported by Zurahman[2].

Madura cattle are one of Indonesia's local breeds of broiler cattle that are widely bred in East Java, especially on Madura Island. There are about 4.5 million broiler cattle in East Java, about 950,000 of which are on Madura Island, almost all of which are Madura cattle. The role of Madura cattle is very important as an asset for beef cattle, labor and tourism in Indonesia. Determination of Madura Cattle Clump with Ministerial Decree No. 3755/KPts/HK: 3755/KPts/HK.040/11/2010 dated November 23, 2010 is one of the Central Government's steps to protect and develop Madura cattle as Indonesian germplasm. Special attention in improving the genetic quality of Madura cattle is also carried out with the issuance of the Indonesian National Standard (SNI) for Madura cattle in 2013 [3].

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Productivity of cattle can be seen from production performance, such as live weight and body weight gain. One of the production performances that can increase beef cattle productivity is birth weight and weaning weight. Other factors that affect birth weight include genetics, feed, mother's body weight, season, and calf sex. Season is one of the factors that affect cattle performance, the direct influence of season on cattle is related to the availability of forage and environmental conditions which have a major impact on the reproductive activity of these cattle supported by Setiawan [4]. Therefore, it is necessary to pay attention to the management of Madura cattle in order to achieve high slaughter weight and carcass quality to meet domestic meat needs.

2. MATERIAL AND METHODS

2.1. Material

The research materials were Madura cattle and recorded data of body weight weighing, namely 128 Madura cattle that were weighed at the beginning of birth and 128 cattle when weaned at the age of 205 days. The scales used used digital scales Tru-Test-ID 5000 brand connected to Cattle Crush, with a maximum capacity of 1500 Kg with an accuracy level of 2.5 Kg.

2.2. Methods

This research method uses a case study with direct observation of field conditions and collecting secondary data. Data collected were obtained from birth records including cattle identity, birth weight, weaning weight, sex, and calf body size. Rainfall data was obtained from the BPS-Statistics of South Kalimantan Province.

2.3. Research Variables

The variables observed in this study were rainfall (mm), birth weight (kg), weaning weight aged 205 days (kg), and body size (cm).

2.4. Data Analysis

Correlation and simple linear regression tests. To determine the strength of the relationship between one variable and another.

The correlation test can be calculated by the formula:

$$r = \frac{n\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{\{n\Sigma X^2 - (\Sigma X)^2\}}\sqrt{\{n\Sigma Y^2 - (\Sigma Y)^2\}}} \quad (1)$$

Description:
r = correlation coefficient
X = first variable
Y = second variable
n = number of measurements

Simple linear regression can be calculated by the formula:

$$Y = a + bX \quad (2)$$

Description:
Y = dependent variable
a = constant value
b = regression coefficient value
X = independent variable

The value of a can be calculated by the formula:

(3)

$$a = \frac{\Sigma Y\,(\Sigma X^2) - \Sigma X \Sigma XY}{n\Sigma X^2 - (\Sigma X)^2}$$

The value of b can be calculated by the formula:

$$b = \frac{n\Sigma XY - \Sigma X \Sigma Y}{n\Sigma X^2 - (\Sigma X)^2} \quad (4)$$

The t-test was conducted to determine the difference in the average birth weight of calves in the rainy season and dry season. The t-test was also conducted to determine the difference between the birth weight of male and female calves.

The t test can be calculated using the formula:

$$t = \frac{|X_1 - X_2|}{\sqrt{S^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \quad (5)$$

Description
X_1 = average of variable 1
X_2 = average of variable 2
n_1 = number of samples of variable 1
n_2 = number of samples of variable 2
S^2 = combined variance

3. RESULTS AND DISCUSSION

3.1. General Overview

BPTU Pelaihari is a government institution tasked with producing superior cattle for breeding, one of which is Madura cattle located in Tanah Laut, South Kalimantan. BPTU has a land area of ± 89.1 ha with a population of 216 Madura cattle. Tanah Laut Regency has an area of 3,631 km^2 located in the position of 3° 52′ 59.88″ S, 114° 52′ 0.12″ E, supported by BPS 2023 [5]. Pelaihari, the seat of the regency, has a tropical rainforest climate with moderate rainfall from July to October and heavy to very heavy rainfall from November to June with an average temperature of 22^{o}C - 31^{o}C, supported by BMKG 2020[6].

3.2. Correlation between Birth and Weaning Weight

Tabel 1. Correlation and Regression Equation between Birth Weight and Weaning Weight

N	r	R^2(%)	Linear equations
125	0,53	28,5 %	Y=35,05 +4,44X

The correlation value between birth weight and weaning weight was 0.53. This correlation value was strong and positive, which means that the higher the birth weight, the higher the weaning weight. This indicates that birth weight was very important to maintain in order to produce optimal weaning weight. In addition, by looking at this value, we can also make a benchmark that we can make an early selection using only birth weight data because selection on birth weight will also affect weaning weight. Noor [7] states that genetic progress in the selection of two or more traits can be influenced by the genetic correlation between the selected traits. Some of the factors that affect birth weight are the genetics of the parents, parent nutrition, parent health, and the type of birth of offspring. The linear regression value is Y= 35.05 + 4.44X which means that every additional 1 kg of birth weight, the weaning weight will increase by 4.44 kg.

3.3. Average Birth and Weaning Weight and Linear Body Size of Male and Female

Tabel 2. Average Birth Weight and Linear Body Size of Male and Female Calves

variable	sex	Average	N (head)
Birth Weight (kg)*	Male	20,28 ± 3,06	59
	Female	18,33 ± 2,98	67
Body length (cm)*	Male	53,44 ± 3,76	59
	Female	51,49 ± 3,50	67
shoulder height (cm)*	Male	66,91 ± 3,73	59
	Female	65,21 ± 3,95	67
chest circumference (cm)	Male	61,73 ± 4,04	59
	Female	60,59 ± 3,95	67

Note: (*) = significant ($p<0.05$)

Sex has an effect on birth weight, body length and shoulder height of Madura cattle, while chest circumference has no effect. Birth weight and linear body size of Madura cattle are influenced by birth type and sex. This is in accordance with the statement of Syarifuddin and Wahdi [8] that calf sex has a relationship with birth weight. while genetic factors derived from elders will be more influential when the cattle grow up, usually starting to show its influence at weaning age. The birth weight of Madura cattle reported by Gunawan [9] is 14 kg, meaning there is an increase in genetic quality where the birth weight of Madura cattle at BPTU Pelaihari was 20.28 ± 3.06 for males and 18.33 ± 2.98 for females.

Tabel 3. Average Weaning Weight and Linear Body Size of Male and Female Calves

variable	sex	Average	N (head)
Weaning Weight (kg)	Male	124,32 ± 28,91	59
	Female	116,96 ± 23,36	67
Body length (cm)	Male	95,58 ± 7,92	59
	Female	92,56 ± 9,69	67
shoulder height (cm)*	Male	103,63 ± 7,00	59
	Female	99,93 ± 6,89	67
chest circumference (cm)	Male	116,89 ± 10,75	59
	Female	114,65 ± 11,62	67

At weaning age, male and female Madura cows showed significant differences in shoulder height, while at weaning weight body length, and chest circumference did not show significant differences. Weaning weight for male Madura cattle was 124.32 ± 28.91 kg, while females were 116.96 ± 23.36 kg. Factors affecting weaning weight are genetic parents, nutrition, and birth weight. Lawrence *et al*.[10] mentioned that the body weight for cattle was higher due to male cattle hormones and the mother's milk production will be more when breastfeeding male calves. The hormone testosterone was one of the androgen steroids produced by the testes that plays a role in growth and will certainly differ according to body composition between male and female sexes. Larger body weight and body size can cause dominance in fighting for food in grazing patterns. The weaning weight of Madura cattle in BPTU Pelaihari, both males and females, does not show a significant difference so that the dominance of bulls over females does not occur so that the maintenance pattern with a mixed grazing system between males and females is not a problem until weaning age. At weaning age, the only difference between males and females is in shoulder height. With a grazing system, shoulder height does not affect the level of ease of access to food because grass and concentrate are given in a place that is positioned below.

3.4. Average Birth and Weaning Weight and Linear Body Size on Birth Season

Tabel 4. Average Birth Weight and Linear Body Size on Birth Season

variable	Birth season	Average	N (head)
Birth Weight (kg)	Rainy	19,91 ± 3,21	60
	Dry	19.93 ± 3,09	66

Body length (cm)	Rainy	52,07 ± 3,55	60
	Dry	52,71 ± 3,91	66
shoulder height (cm)	Rainy	66,32 ± 4,00	60
	Dry	65,72 ± 3,86	66
chest circumference (cm)	Rainy	61,17 ± 4,08	60
	Dry	61,09 ± 3,98	66

The timing of birth in different seasons had no effect on birth weight, body length, shoulder height and chest circumference. This indicates that Madura cattle have resilience to the uncertain environment even during the dry season when the quality of forage decreases compared to the rainy season. In addition to decreased nutritional quality during the dry season, the temperature of the environment also usually increases which can cause cattle to become more stressed. However, the results obtained show that the level of resilience of Madura cattle in the face of heat stress is also good.

Tabel 5. Average Weaning Weight and Linear Body Size on Birth Season

variable	Birth season	Average	N (head)
Weaning Weight (kg)	Rainy	117,28 ± 24,56	60
	Dry	123,24 ± 27,59	66
Body length (cm)	Rainy	93,26 ± 8,94	60
	Dry	94,62 ± 9,07	66
shoulder height (cm)*	Rainy	99,72 ± 6,86	60
	Dry	103,43 ± 7,02	66
chest circumference (cm)	Rainy	113,95 ± 10,89	60
	Dry	117,29 ± 11,39	66

Note: (*) = significant ($p<0.05$)

At weaning age, significant differences occurred only in shoulder height, while weaning weight, body length, and chest circumference were not significantly different. The shoulder height at birth of madura cattle born in the rainy season was 66.32 ± 4.00 cm and 65.72 ± 3.86 cm in the dry season, while at weaning age the shoulder height was 99.72 ± 6.86 cm for those born in the rainy season and 103.43 ± 7.02 cm for those born in the dry season. The significant difference in shoulder height of madura cattle born in different seasons at weaning age may be due to the influence of genetic factors of the parents. According to BIF [11], weaning weight can be used to evaluate differences in growth potential of calves and lactation ability of Dam.

CONCLUSION

In conclusion, the season and birth weight did not significantly affect body length, chest girth, and linear body measurements. However, they did significantly affect shoulder height at the weaning age of Madura cattle.

AUTHOR'S CONTRIBUTIONS

Muhammad Pramujo designed the research, formal analysis, data curation and writing (original data, review and editing). Jack Pujianto collecting data. Wike Andre Septian, Much. Helmi Bahtiyar, Veronica Margareta Ani Nurgiartiningsih designed the research and conducted the analysis.

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