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Study of the Physical and Physiological Response of the Madura as a Breeding Source (Case Study in Waru Sub-District, Pamekasan District)

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Abstract.

The study aimed to determine the physical and physiological response of the Madura bull as a breeding source. This study used 30 Madura bulls aged >12-24 months at Waru Sub District, Pamekasan District. The physical evaluation was performed including qualitative and quantitative characteristics. Physiological response was evaluated based on rectal temperature, respiration rate, and pulse rate. Physiological status measurements were carried out in the morning, day, and afternoon. This study used descriptive methods and direct observation. The results showed that qualitative characteristics of Madura bulls including color, ear shape, horn, tail tip warrants, back shape, leg shape and muzzle color already followed the SNI standards for the Madura beef cattle. According to quantitative characteristics, Madura bulls have 157 cm ± 12,6 chest circumference, 121 cm ± 10,8 body length, and 118,83 cm ± 7,21 height on average. These measurements were above the minimum standards set by SNI for the Madura beef cattle. The average temperature rectal of Madura Bull in the morning, day and afternoon were 37.5^0 C ± 0,46, 38.6^0 C ± 0,49 and 38.2^0C ± 0,42 respectively. The average pulse rate of Madura Bull in the morning, day and afternoon were 60.8 ± 0,37, 68.6 ± 4,01, and 65.6 ± 0,67 times per minute respectively. Respiration rate of Madura Bull in the morning, day and afternoon were 19 ± 0,25, 35.6 ± 2,11 and 25.7 ± 0,67 times per minute. Generally, the physiological status of Madura Bull including temperature rectal, pulse rate, and respiration rate were in normal conditions.

Keywords: Madura Cattle, Bull, Physical, Physiological Response

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1. Introduction

Indonesia has various types of local cattle which is Madura Cattle. Types of this local cattle come from different genes and hereditary cultivated by people in Indonesia so specified as local cattle that need to be guarded and kept preserved (Decree of the Minister of agriculture No. 3735/Kpts/HK.040/11/2010). Madura cattle are thought to be the result of a cross between Bali cattle (*Bos sundaicus*) and zebu cattle (Bos indicus). Some others argue between a banteng with a mixture of zebu (*Sinhalese*) and short horn type cows, or between banteng (*Bos / Bibos sundaicus*) and local cattle in Central

Java who then get additional Zebu cattle blood [1]. In other words, the origin of Madura cattle has the blood of *Bos indicus*, *Bos sundaicus* and at the same time *Bos taurus*. This is evidenced by the results of measurements of the body parts of bulls between Bali cows (which are widely thought to be the result of domestic banteng) and zebu (Ongole breeds).

Madura cattle are local beef cattle formed as a result of natural isolation and environmental influences. Madura cattle is one of them Indonesian local livestock that have characteristics specifics which most likely aren't owned by other exotic livestock. Among these characteristics is resilience environmental conditions tropical with temperature and humidity high daily, quality feed conditions low and stress to variety parasites [2].The performance, health, and well-being of livestock are strongly affected by climate. High ambient temperatures, high direct and indirect solar radiation and humidity are environmental stressing factors that impose a strain on animals. Among the environmental variables affecting livestock, heat stress seems to be one of the most intriguing factors hampering animal production in many regions of the world. Thermal stress effects on livestock are of multifactorial nature. It directly alters and impairs the cellular functions in various tissues of the body and the redistribution of blood flow, as well as the reduction in food intake, which ultimately results in reduced production performance [3]. One indicator to see the environmental impact on cattle is to measure and evaluate the physiological response, whether the cattle are in a comfort zone or not, which will have an impact on productivity.

2. Materials and Methods

The study was conducted at the source of breeds in Waru sub-district, Pamekasan district. The land type is high land with 157 meter above the sea level.the humidity 80% respectively during the wert and hot periode, mean annual temperature is about 30˚C to 31˚C. This study used 30 Madura bulls aged >12-24 months . The physical evaluation was performed including qualitative and quantitative characteristics. Physiological response was evaluated based on rectal temperature, respiration rate, and pulse rate. Physiological status measurements were carried out in the morning, day, and afternoon. This study used descriptive methods and direct observation.

3. Results and Discussion

3.1. Physical Character

At a glance quantitative characteristics of madura Bull described in Table 1. Madura Bull have an average body length, height and chest circumference of 121 cm ± 10.83, 118.83 cm ± 7.21, and 157 cm ± 12.6. These measurements were above the minimum standard set by SNI about Madura beef cattle [3]. The body length of the madura Bulls is higher than that of the pasundan cattle is 114,98±1,82 [4] , and Sumbal (Sumbawa bali) Male is 119,44±13,09 [5] . The growth rate of an animal can be influenced by genetic, environmental, feed, management and gender factors [6], Male cattle have androgen hormones, which are sex hormones produced by the testes and function to stimulate protein synthesis, especially in muscle, resulting in faster growth [7]. In the results of height measurement, Madura Bulls have an average size that is not much different from Sumbal cattle, namely 118.67 ± 9.22 [4]. The Madura, Coastal, Bali and PO Cattle groupings appear to be real different and enter the Bos indicus cattle cluster and from the Zebu maternal [8]. The size of the chest circumference of Madura Bull is known to be greater than that of Bali Bull namely 138,84±6,82 [9].

The size of the chest circumference in cows is influenced by genetic, environmental, feed, management, and gender factors. Genetics can be inherited from the parents such as the race of a livestock which will be clearly seen if it has its own characteristics. The environment includes feed, climate, management and health. The growing livestock grows 1% of the chest circumference, followed by an increase in live weight of 3%. Livestock will increase with age. Thoracic circumference may influence the respiratory rate limiting lung expansion at inspiration. Animals with greater thoracic circumference (TC) may exchange larger air volumes and thus more heat lost to the environment through the vapor released in the breath without increasing their respiratory rate [19]. Young cows need a high protein and energy feed for muscle, bone and fat growth. Growth is the easiest yardstick for assessing productivity, shoulder height, body length and chest circumference [10]. The canonical correlation showed that thoracic circumference was the main physical component that had relationship with the physiological variables in both morning and afternoon periods. In the morning, the white blood cell value had the highest correlation with the physical variables, and was the hematological component that had the greatest variation between time and breed. In the afternoon, the positive canonical correlations between physical parameters and respiratory rate, packed cell volume and surface temperatures showed that the latter was affected by animal size, as larger animals have smaller surface area to lose heat [20].

Table 1: quantitative characteristics of madura Bull

Parameter	Mean ± SD
body length	121 cm ± 10,8
height	118,83 cm ± 7,21
chest circumference	157 cm ± 12,6

Table 2: qualitative characteristics of madura Bull.

Part of body	Character
Coat Colour	reddish brown
Ears	Medium sized, strong and erected
Horns	Horned, Upper curved (stumpy), Forward curved,black colour
Muzzle	Black
Eyes	Alert, bright, big and prominent black
Backline	Presence,absence
Tail	Moderate length reaching the hock joint with medium amount of hair, black tail tip
leg	Short, strong and usually Light brown stocking on all four legs,

At a glance qualitative character described in Table 2. The dominant coat color of Madura Bull found to be reddish brown. The solid reddish brown coat color was the major color in several found in Indonesian local cattle such as Aceh (Bos indicus), Katingan (Bos indicus x Bos javanicus), and Pesisir breeds [8, 11, 12,13]. The most common color of switch of horns, muzzle, eyes, and tail tip was found to be black. the major black color characteristics were found on muzzle and switch of tail in Pasundan Cattle and similar to Madura Bull. It may that the black color on horn, eyelids, muzzle, horn and tail switch in Madura Bull originated from Bos indicus (Pasundan or Ongole). The light brown colors on legs and rump patch in the Madura Bull cattle were derived from Bali cattle [14]. Most of Madura Bull cattle were horned with horn tips orientation of upper curved/stumpy. the stumpy horn in Madura Bull is similar to many Indonesian indigenous cattle breeds such as Aceh (20%), Ongole grade (32.30%) and Pasundan (93,3 %) [8, 12, 15]. Overall qualitative characteristics of Madura bulls already followed SNI about Madura beef cattle.

3.2. Physiological response

Physiological response of Madura Bull to the environmental conditions in Waru sub distric had been monitored through the physiological profiles, which consist of rectal

temperature, body temperature, and respiration rate every morning, Evening and afternoon. Rectal temperature and respiration rate are parameters that could be measured to know the heat stress of cattle [15]. Rectal temperature is the optimal parameter for measuring body temperature due to better reflect the core body heat balance rather than the temperature of the surface of the skin. Average rectal temperature, pulse rate, and respiration rate shown in Table 3.

The rectal temperature of Madura Bull in the morning and afternoon of Hatri has increased, while in the afternoon it has decreased compared to during the day. This is because the body temperature in livestock is influenced by several factors, namely environmental temperature, activity, feed, drinking, and digestion. One of the efforts of the livestock body to maintain body heat balance when the air temperature in the pen increases is by increasing the frequency of respiration. During morning animal always in resting condition, which cause reduce temperature, pulse and respiration rate where as after grazing in the hilly field the animal perform exercise and show high temperature, pulse rate and respiration in all groups of animals.Respiration can be influenced by posture, physical work, and metabolism. Environmental temperature can cause various changes in the physiological reactions of animals, namely increasing body temperature, increasing respiratory rate and increasing pulse rate. In the morning, the lower the body surface temperature the lower the heart rate. With lower temperatures, the body surface temperature decreased, probably due to skin vasoconstriction to maintain internal body temperature and reducing the pulse rate. In the afternoon, increased heart rate may be to be due to increases in peripheral vasodilation and heat loss. With the increase in heart rate, vasodilation can also increase to maintain blood pressure and adequate blood supply to other tissues as well as the vasoconstriction of the gut tissue to support vasodilation during heat stress. Also in the afternoon, rectal temperature and respiratory rate were closely grouped probably as a response to higher environment temperatures recorded in this period. With an increase in the rectal temperature, the animal increases its respiratory rate trying to reduce the forme [16].

Rectal temperatures were within the reference value for cattle, between 36.7 ˚C and 39.1 ˚C [17], showing that all the groups were able to maintain their homeothermic condition although air temperatures in the morning and afternoon were considered stressful as seen in changes in the physiological parameters. The results of the analysis of the respiratory frequency in the morning, afternoon and evening showed normal values. which states that normal respiration in adult cattle is 15-35 times / minute [18]. The results showed that the average pulse rate of Madura Bull was in the range of 60 - 68 beats per minute. The pulse rate frequency is in the normal range. The normal

Pulse rate conditions of the cattle in the tropics ranges from 40-70 beats per minute. Stated that the older the cows are, the physiological abilities in the thermoregulation mechanism will increase.

TABLE 3: Physiological parameters of Madura Bull.

Parameters	Day Time	Mean ± SD
Rectal Temperatur	Morning	37,5 ± 0,46
	Evening	38,6 ± 0,49
	Afternoon	38,2 ± 0,42
Pulse Rate	Morning	60,8 ± 0,37
	Evening	68,4 ± 4,01
	Afternoon	65,6 ± 0,67
Respiration Rate	Morning	19,1 ± 0,25
	Evening	35,6 ± 2,11
	Afternoon	25,7 ± 0,67

4. Conclusions

The physical character of Madura Bull already followed SNI about Madura beef cattle. Generally, the physiological status of Madura Bull including temperature rectal, pulse rate, and respiration rate was in normal condition.

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