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RESEARCH ARTICLE

PHYSIOLOGICAL CHARACTERIZATION THROUGH BODY TEMPERATURE AND RESPIRATION FREQUENCY OF BEEF CATTLE IN PANGANDARAN

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ABSTRACT

Physiological status is one of the indicators to determine the health status and productivity of livestock animals. This study aimed to characterize the physiological status of beef cattle in Pangandaran area through the measurement of body temperature dan respiration frequency. In total, 10 Ongole beef cattle, blocked by sex (6 bulls and 4 cows) and age (12 and 24 months), weighed 250±10 kg was involved in this study. The measured parameters were body temperature (consisted of three measurement points: head, body, and rectal) and respiration frequency. The data were analyzed by analysis of variances (ANOVA) to determine the effects of sex and age. The results showed that there were no effects of neither sex nor age to body temperature and respiration frequency (P>0.05). Body temperature data for bulls and cows were ranged at 30.44°C-31.11°C and 31.24°C-32.62°C, respectively. While the respiration frequency for bulls and cows were averaged at 35.11 times/minute and 30.90 times/minute, respectively. In conclusion, the physiological status of beef cattle in Pangandaran have been characterized through body temperature and respiration frequency, with no significant effect of neither sex nor age on both body temperature and respiration frequency. The data of this study, in turn, can be used by farmers to optimize management and achieve optimal productivity and profitability.

KEYWORDS

beef cattle, sex, body temperature, respiration frequency, characterization.

1. INTRODUCTION

As a homeothermic animal, beef cattle possess the ability to regulate its body temperature. This thermoregulation ability is the results of genes that acquired thermotolerance control (Hansen, 2004) which plays an important role as indicator of health and productivity status of beef cattle. While, one of the ways to control body temperature is through the evaporative loss in the way of respiration (Taylor et al., 1969; Finch, 1986). The understanding of body temperature control in cattle and its relationship of the productivity becomes important, as the productivity level is also indicated by physiological status that can be measured through body temperature regulation and respiration frequency. In addition, increase of body temperature and respiration frequency was reported to have a relationship with reduced of feed intake and meat production (Hahn, 1999), and can result in death in extreme conditions (Armstrong, 1994).

Body temperature is one of the best indicators of heat load on cattle (Gaughan and Mader, 2014). While respiration rate (together with sweating) plays a role as evaporative heat loss. When the sweating and respiration rate were not sufficient for maintenance of homeothermy, body temperature rises (Gaughan and Mader, 2014). Therefore, both respiration rate and body temperature are related, which combined into the panting mechanism (Gaughan et al., 2010).

Pangandaran is a regency in south-eastern part of West Java Province, Indonesia. This area is having a tropical-oceanic climatic condition which tends to have a high air temperature, high humidity, and high windspeed. Beef cattle in Pangandaran area is thought to have a thermal stress, caused by that kind of climatic condition.

To our knowledge, the default physiological status of beef cattle in Pangandaran area has not been yet characterize. Considering the importance of physiological status in animal wellbeing, health, and productivity, we aimed to characterize physiological status of beef cattle in Pangandaran area through body temperature and respiration frequency measurements, which in turn might be used as a basis of health, productivity, and welfare standard for stakeholders.

2. MATERIALS AND METHODS

2.1 Animals, housing, and data measurements

This study involved 10 Ongole Grade (OG) cattle, blocked by sex (6 bulls and 4 cows), aged 24±4 months, weighed 250±20 kg. The ration fed is 100% napier grass without any treatments except withering process for 24 hours. The drinking water is provided *ad libitum*. Ten asbestos-shaded and earthen-floored individual pens (sized 2×1 meter) with a feed bank at the front of each pens. The body temperature was measured using an infra-red thermometer (IRTek IR60i, Australia) in three measurement

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point, namely head, body, and rectal. Respiration frequency was measured by manual count by detecting air exhalation from animal's nose confirmed with the movement of abdomen.

2.2 Statistical analysis

Data were statistically analyzed with analysis of variance (ANOVA) to detect the effects of sex and age, using PROC GLM in SAS Statistics 9.2 (SAS Institute Inc., 2008). Values in the results section are presented as least square means (LSMeans) with their pooled standard error of means (SEM). All effects were considered significant at the level of $\alpha = 0.05$.

3. Results and Discussion

Table 1: Rectal, body, head temperature (°C), respiration frequency, and the effects of sex and age of beef cattle in Pangandaran area (LSMeans ± SEM).

Item	Sex		SEM	Age		SEM	p-value	
	M (n=3)	F (n=7)		1 (n=4)	2 (n=6)		Sex	Age
Rectal Temperature (°C)	31.11	32.62	0.49	31.33	32.72	0.55	0.206	0.2139
Body Temperature (°C)	30.44	31.24	0.82	30.92	31.06	0.66	0.4171	0.8819
Head Temperature (°C)	30.67	31.81	0.42	31.17	31.67	0.45	0.0663	0.4316
Respiration Frequency (times/minute)	35.11	30.90	2.29	34.17	30.83	2.17	0.2479	0.334

There were no rectal temperature differences ($p>0.05$) both between male (31.1 ± 0.5 °C) and female (32.6 ± 0.5 °C) cattle and between 1-year old (31.3 ± 0.5 °C) and 2 years old (31.1 ± 0.5 °C) cattle (Table 1). Consequently, there were no body temperature differences ($p>0.05$) both between male (30.4 ± 0.8 °C) and female (31.2 ± 0.8 °C) cattle and between 1-year old (30.9 ± 0.6 °C) and 2 years old (31.1 ± 0.6 °C) cattle (Table 1). In line with that, there were no head temperature differences ($p>0.05$) both between male (30.7 ± 0.4 °C) and female (31.8 ± 0.4 °C) cattle and between 1-year old (31.1 ± 0.4 °C) and 2 years old (31.7 ± 0.4 °C) cattle (Table 1). Regarding the respiration frequency, there were no head temperature differences ($p>0.05$) both between male (35.1 ± 2.3 times/minute) and female (30.9 ± 2.3 times/minute) cattle and between 1-year old (34 ± 2.2 times/minute) and 2 years old (30.8 ± 2.2 times/minute) cattle (Table 1).

This study is aimed to characterize and report the physiological status of beef cattle in Pangandaran area. The importance of this study lies on the fact that body temperature increased when there is an increased heat load caused by a combination of air temperature, relative humidity, air movement, and solar radiation which in turn affected the feed intake and meat production (Schütz et al., 2010). The location of this study, Pangandaran, has a tropical-oceanic climate, with average temperature range of 24 – 32°C, with the average relative humidity of 85%(Kementerian Pekerjaan Umum Republik Indonesia, 2016).

Based on our findings, the body temperature ranged at 30.67-32.62°C which 5°C lower compared to previous studies (Piccione et al., 2003; Schütz et al., 2010; Gaughan and Mader, 2014). Similarly, the respiration frequency in this study was also lower than previous studies (Piccione et al., 2003; Schütz et al., 2010), which having an ambient temperature range of 5 – 30°C with relative humidity range of 39 – 96%. These difference suggested the effects of other weather variable, such as the wind speed, solar radiation, rainfall, which in turn reflected by temperature-humidity index (Igono et al., 1992). Moreover, the strain of the cattle considered affected the thermotolerance, in which OG cattle (categorized into Zebu cattle [*Bos indicus*]) is having better thermoregulatory adaptability compared to *Bos taurus* cattle (Hansen, 2004).

There were no effects of neither sex nor age to rectal temperature, body temperature, head temperature, and respiration frequency in this study which might suggesting same level of metabolism in different sex and age. The results might also suggest that the shading of the housing made homogenous microclimate for all beef cattle regardless of sex and age. It was reported that the access to shade reduced the impact of heat load (Gaughan et al., 2010), which might also be reflected in this study.

The data of current study demonstrate the early effort to characterize default physiological status of beef cattle in Pangandaran. However, a larger group of samples are required to improve the reliability of the data, which in turns can be used as a basis of physiological status standard of beef cattle in Pangandaran.

4. Conclusion

This study is an early effort to characterize beef cattle physiological status in Pangandaran area. The physiological status of beef cattle in Pangandaran area have been characterize, although a larger group of samples is required to improve data reliability to standardize the physiological status of beef cattle in Pangandaran. Nevertheless, the data of this study, in turn, can be used by farmers to optimize management and achieve optimal productivity and profitability.

References

Armstrong, D.V. 1994. Heat Stress Interaction with Shade and Cooling. Journal of Dairy Science, 77:2044–2050. Doi: https://doi.org/10.3168/jds.S0022-0302(94)77149-6.

Finch, V.A. 1986. Body Temperature in Beef Cattle: Its Control and Relevance to Production in the Tropics. Journal of Animal Science, 62:531–542. Doi: 10.2527/jas1986.622531x.

Gaughan, J.B., and T.L. Mader. 2014. Body temperature and respiratory dynamics in un-shaded beef cattle. International Journal of Biometeorology, 58:1443–1450. Doi: 10.1007/s00484-013-0746-8.

Gaughan, J.B., S. Bonner, I. Loxton, T.L. Mader, A. Lisle, and R. Lawrence. 2010. Effect of shade on body temperature and performance of feedlot steers. Journal of Animal Science, 88:4056–4067. Doi: 10.2527/jas.2010-2987.

Hahn, G.L. 1999. Dynamic responses of cattle to thermal heat loads. Journal of Animal Science, 77:10–20. Doi: 10.2527/1997.77suppl_210x.

Hansen, P.J. 2004. Physiological and cellular adaptations of zebu cattle to thermal stress. Animal Reproduction Science, 82–83:349–360. Doi: https://doi.org/10.1016/j.anireprosci.2004.04.011.

Igono, M.O., G. Bjotvedt, and H.T. Sanford-Crane. 1992. Environmental profile and critical temperature effects on milk production of Holstein cows in desert climate. International Journal of Biometeorology, 36:77–87. Doi: 10.1007/BF01208917.

Kementerian Pekerjaan Umum Republik Indonesia. 2016. Profil Kabupaten Pangandaran. Kementerian Pekerjaan Umum Republik Indonesia, Jakarta.

Piccione, G., G. Caola, and R. Refinetti. 2003. Daily and estrous rhythmicity of body temperature in domestic cattle. BMC Physiology, 3:7. Doi: 10.1186/1472-6793-3-7.

SAS Institute Inc. 2008. SAS/STAT® 9.2 User's Guide. SAS Institute Inc., Cary, NC.

Schütz, K.E., A.R. Rogers, Y.A. Poulouin, N.R. Cox, and C.B. Tucker. 2010. The amount of shade influences the behavior and physiology of dairy cattle. Journal of Dairy Science, 93:125–133. Doi: https://doi.org/10.3168/jds.2009-2416.

Taylor, C.R., D. Robertshaw, and R. Hofmann. 1969. Thermal panting: a comparison of wildebeest and zebu cattle. American Journal of Physiology, Content 217:907–910. Doi: 10.1152/ajplegacy.1969.217.3.907.