

# Physiology Value of Breath, Pulse and Body Temperature of Cattle

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**Abstract.** Body temperature, respiratory rate, and pulse rate are required as the basis for determining the health status of cows. This study aims to measure the respiratory rate, pulse rate and body temperature of healthy beef cattle. A total of 25 mixed-breed beef cattle aged more than 1.5 years were used in this study. All cows were physically examined, their breath, and pulse frequency per minute were calculated, and their body temperature was measured by measuring rectal and vaginal temperature. The results showed that all the cows examined were in good health, characterized by a good appetite, and had normal activities. Cows had a respiratory rate of 20 – 44 times/minute with an average of  $32.6 \pm 6.8$  times/minute, and a pulse frequency of 76 – 96 times/minute with an average of  $84.2 \pm 5.4$  times/minute. Measurement of body temperature of cows per vagina was 37.9 – 39.4 °C with a mean of  $38.53 \pm 0.42$  °C, while per rectal showed 37.7 – 39.2 °C with a mean of  $38.49 \pm 0.38$  °C. The results of temperature measurements using the two methods did not show a significant difference. It was concluded that the respiratory rate of 20 – 44 times/minute, pulse frequency of 76 – 96 times/minute, and body temperature of 37.7 – 39.4°C were the physiological parameters of the healthy mixed-breed cow.

## 1 Introduction

Cattle are a mainstay commodity for farmers in Indonesia. To fulfil a target for meat sufficiency in 2026, the Indonesian government has committed to increasing the cattle population with a program called Siwab or Mandatory cattle breeding [1–2]. However, the program that aims to increase the cattle population is currently experiencing many obstacles. Several factors affecting the increase in cattle population include limited grazing land, expensive feeding costs, and diseases affecting the cattle [3]. The causes of reproductive diseases in cattle are divided into infectious and non-infectious diseases. According to Jumaryoto et al. [4], cows with infectious diseases experienced changes in the body's physiological data which includes respiratory rate and pulse rate.

Body temperature, respiratory rate, and pulse rate are required as the basis for determining the health status of cattle. In Indonesia (Yogyakarta), almost all references for the physiological value of cattle use non-Indonesian references. Measurement of body temperature in cattle is usually done rectally, but sometimes this method could be a problem when there is local inflammation in the anus. Therefore, an alternative body part is used for the temperature measurement. In female cattle, body temperature could be measured through their vagina. This study aimed to measure the respiratory rate, pulse rate,

and body temperature of healthy beef cattle, and compare body temperature measured in the vagina and rectum.

## 2 Materials and Methods

This study used 25 mixed-breed cows (Limosin-Peranakan Ongole, PO) aged more than 1.5 years old, in Ngaglik subdistrict, Sleman district. The cattle were physically examined in the afternoon with an environment temperature of about 25 °C and a humidity of 78 – 91%. All cows were physically examined, their pulse and breath frequency per minute were calculated, and their body temperature was measured by measuring rectal and vaginal temperature [4–5]. Pulse rate was determined by palpation on the coccygeal artery. Breathing frequency was measured by placing the back of the hand in front of the cattle's nose and counting the frequency of the inhale-exhale process within one minute [5]. Body temperature was determined by placing the thermometer in the rectum and vagina for one minute. The data for physical examination, respiration, and pulse rate were analyzed descriptively; while the data for body temperature was analyzed using a T-test. This study has permitted by ethical clearance committee of Faculty of Veterinary Medicine, Universitas Gadjah Mada, Indonesia, with number: 002/EC-FKH/Int./2022.

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### 3 Results and Discussions

Results of physical examinations in this study showed that all the cattle were in good health, characterized by a good appetite, and had normal activities. Pulse rate was 76 – 96 times/minute with an average of  $84.2 \pm 5.4$  times/minute (Table 1). The pulse frequency of cows in the study was relatively higher than the previous studies in healthy female Ongole (PO) crossbreed after calving on the 3<sup>rd</sup> – 66<sup>th</sup> day by  $62.00 \pm 4.90$  to  $81.60 \pm 8.05$  times/minute [4]. Other studies reported that the pulse frequency for healthy cattle was 40 to 70 times/minute, 46 – 84 times/minute, for heifer was  $67.40 \pm 8.41$  times/minute, and for pregnant cattle was  $76.66 \pm 7.88$  times/minute [6–9]. Despite the relatively higher pulse frequency in this study compared to other studies, the cows were in healthy condition. The results of the physical examination in this study showed that the cows had no difficulty in their activities, had a good appetite and there was no excessive fluid from the mouth, nose, anus, and vagina.

**Table 1.** Pulse and breathe rate and body temperature of mix-breed cows.

Criterion	Rate (times/minute)		Temperature (°C)	
	Pulse	Breath	Vagina	Rectum
Minimum	76.0	20.0	37.9	37.7
Maximum	96.0	44.0	39.4	39.2
Average	$84.2 \pm 5.4$	$32.6 \pm 6.8$	$38.53 \pm 0.42^*$	$38.49 \pm 0.38^*$
[6–9,16,24–25]	40 – 84	16 – 33	38.5	36.7 – 39.1

\*The same superscript in the same line are not significantly different ( $P > 0.05$ )

Feils and Magee [10] mentioned that the initial action potential occurs spontaneously in a particular set of myocardial cells found in the sinoatrial (SA) node of the heart, which is innervated by both sympathetic and parasympathetic nerves to increase and decrease the rate. According to [10–11] pulse frequency can be affected by physical activity, illness, or stress. The increasing pulse frequency can be caused by hot weather temperatures [9,12–13]. Pathological increase in pulse rate can be caused by heart or respiratory tract problems [14–15].

The task of an animal’s heart is closely related to the respiratory system. The main function of the lungs is to take in O<sub>2</sub> during inspiration and expel CO<sub>2</sub> during expiration [10]. The respiratory rate can be used as a parameter for a healthy respiratory system. The results for the respiratory frequency of cows were 20 – 44 times/minute with an average of  $32.6 \pm 6.8$  times/minute (Table 1). The range of the respiratory frequency in this study was wider than previous studies, which reported  $16.05 \pm 0.82$  to  $20.95 \pm 0.88$  times/minute in adult female Bali cattle [16], and  $21.20 \pm 5.76$  to  $28.80 \pm 5.02$  times/minute in post-calving PO cattle [4]. Animal health conditions, age, body size, physical activity, pregnancy status, digestive tract disorder, respiration, and stress are factors affecting respiratory frequency [10,17–18]. Heat

stress or an increasing temperature also resulted in increasing respiration, heart rate, and evaporation of water through the skin. The day and night temperatures affected the breathing frequency in cattle. Heat stress in cattle could be reduced by keeping cows in cages or free-stall systems with roofs [13,19–20]. Pathological changes in respiratory frequency in cattle can be caused by Mycoplasma spp. infection, bloat, and toxicity [15,21–23]. In this study, all samples did not show any respiratory tract disorder.

Measurement of body temperature of cows per vagina was 37.9 – 39.4 °C with a mean of  $38.53 \pm 0.42$  °C, while per rectal showed 37.7 – 39.2 °C with a mean of  $38.49 \pm 0.38$  °C. The body temperatures measured through the vagina were higher than that in the rectum but the difference between them was not significant (Table 1). These results were slightly higher than [24] which reported that the range of rectal temperature in cows was 36.7 to 39.1°C. Sakatani et al. [25] reported that in summer, the vaginal temperature of estrous and non-estrous cows were 38.73°C and 38.43°C, while during winter, the vaginal temperature of estrous and non-estrous cows were 38.80°C and 38.47°C. A similar result was shown in this study, where a mean vaginal temperature of  $38.53 \pm 0.42$  °C was obtained. All of the cows in this study was not in the estrous phase.

Under physiological conditions, the estrous phase will result in an increase in body temperature. Kyle et al. [26] stated that body temperature would be increase in the estrous phase. The increasing temperature in vagina occurs due to the increasing blood vascularization around the genital organs which is influenced by estrogen and luteinizing hormone [27–29]. The temperature in the vagina can also be affected by the presence of mucus [30]. The increase of body temperature was observed on the day of estrous or during estrous [25,31]. Previous studies indicated that an increase in body temperature was not related to an increase in activity but instead was related to hormonal secretion [28,32]. The expression of luteinizing hormone (LH) surge was the reason for the transient temperature increase during stress [28]. Besides that, changes in body temperature during the estrous cycle may be correlated with the function of the corpus luteum in the ovaries [32].

Body temperature is affected by pathological and physiological conditions such as estrous or parturition [33–34]. However, changes in body temperature are more valuable for evaluating the presence of infection or inflammation in animals. Even though fever does not always indicate a pathological condition, puerperal metritis not long after parturition will results in an increase in body temperature. Hence, body temperature should be measured regularly as part of the health management of cows.

The measurement of cattle’s body temperature in this study indicated that vaginal temperature may be more accurate than rectal temperature as the presence of faeces in the rectum may influence the measurement of rectal temperature. In addition, the greater blood flow in vagina compared to rectum made it more sensitive to changes in temperature, allowing it to be more reliable as it better reflects the core temperature changes [35]. The rectal

temperature had a significant change based on the condition of the cow. The lower rectal temperature obtained maybe because the rectum is less vascularized than the vagina. In addition, rectal temperature changes are influenced by the process of defecation, thus the rectum is not suitable to be used as a representative for measuring the body temperature of cows [36]. Rectal temperature is also affected by the position of the thermometer. The depth of the thermometer inserted in the rectum affects the temperature measurement. Placing the thermometer deeper inside the rectum (6 vs. 11.5 cm) increased the rectal temperature by  $0.4 \pm 0.2$  °C [37].

## 4 Conclusion

The respiratory rate of 20 – 44 times/minute, pulse rate of 76 – 96 times/minute, and body temperature of 37.7 – 39.4°C were the physiological parameters of healthy mixed-breed cows. Vagina could be used as an alternative for body temperature measurement in cattle. These results can be used as a reference to determine the health status of cattle.

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