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Physiological Response of Reared Bali Cattle Based on Different Peat Land Characteristics

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Abstract

This study aimed to investigate the effect of microclimate conditions within cattle houses at wet peatlands and dry peatlands on Bali cow's physiological responses. The study was carried out from November 2017 to February 2018 in Pulang Pisau Regency, Central Kalimantan Province. There were 58 heads of Bali cows used in this study, comprising 38 cattle at wet peatland in Jabiren Raya sub-district and 20 animals at a dry bog in Maliku sub-district. The observed parameters included microclimate conditions. It was air temperature, humidity, and temperature-humidity index, THI and wind speed, physiological responses (respiratory rate, pulse, and rectal temperature) and leucocyte (neutrophils, lymphocytes, and neutrophils/lymphocytes ratio). The results indicated that the morning microclimate at wet peatland showed significantly ($p<0.05$) lower humidity, higher THI, and wind speed than that at dry land. The marked difference of microclimate between the two locations in the afternoon occurred only on wind speed. There were differences between dry and wet peatlands in Bali cow's physiological responses, including respiration rate in the morning, the pulse at noon, rectal temperature in the afternoon, and leucocyte. However, the local cattle' physiological responses kept in wet and dry peatland were still under normal conditions.

Keywords: Bali cattle, microclimate, physiological responses

A. Introduction

Bali cattle are local Indonesian beef cattle that have been domesticated for centuries ago. The spread of Bali cattle has spread to almost all parts of Indonesia. In the development of Bali cattle, in addition to feed and maintenance management factors that need to be considered are the comfortable environmental conditions (comfort zone) with the maximum and minimum temperature and humidity levels in the thermoneutral zone environment to produce optimally. Heat tolerance is the resistance of livestock to the surrounding heat. Extreme environmental conditions due to high temperatures, solar radiation, humidity, and low wind speeds can cause heat stress on animal. Heat stress will be a significant problem in raising livestock, including Bali cattle. Hot strained calves will be reflected in the body's response by increasing the breathing frequency to remove or replace heat with the surrounding air (Suherman *et al*., 2017). The increase in body temperature is caused by environmental temperature (Rahardja, 2010).

The environment has a more significant proportion of the genetic influence of livestock. Production and reproductive performance are influenced by 60% of environmental factors and 40% of genetic factors (Kadarsih, 2003). Proper environmental management must be implemented to produce productivity as expected. It can be done by controlling the microclimate ecological management in the cage. According to Yani & Purwanto (2006), the microclimate can directly affect livestock productivity: temperature, humidity, radiation, and wind speed, while evaporation and rainfall indirectly affect livestock productivity. The direct effect on livestock can cause heat or cold stress, causing uncomfortable conditions. Management of livestock microclimate environmental control needs to be done to determine the comfort level of animals so that it can produce optimal productivity.

The specific characteristics of peatlands with hot and humid agro-climate conditions will impact the status of cattle raised in these locations. One indicator to see the environmental impact on cattle is by measuring and evaluating the physiological response of whether the cattle are in a comfort zone or not, which will impact their productivity. This study analyzed the effect of microclimate conditions in peatland locations on physiological responses and levels of leukocytes in Bali cattle.

B. Methodology

1. *Time and Place of Research*

This study was conducted from November 2017 to March 2018 in Pulang Pisau Regency, Central Kalimantan province. The choice of location was based on the consideration of peat thickness, distance from major rivers, and the existence of beef cattle business in the area. Observations were made in two different locations, Jabiren Raya sub-district represented wet peat. The place of shallow peat (<1.5 meters) was far from the big river was represented by Kanamit Jaya sub-district. Observation of leukocyte levels was observed at the Laboratory of Physiology and Pharmacology, Veterinary Medicine Faculty, Agricultural Institute of Bogor.

2. *Material and Equipment*

The used material in this study was the Bali cow, which was kept in two different locations. Leukocyte differential analysis used a *review of the preparations* that were directly carried out at the study site. The used materials were glass objects, methanol, tissue, and alcohol. The used equipment in this study included a hygrometer of HTC-2 (China) type, wet and dry ball thermometers, digital Anemometer of Sanfix GM816A brand (China) brand, and stopwatch, digital clinical thermometer (Indonesia), project, and preparat box.

3. *Parameters of Research*

a) Microclimate Conditions

The parameters of microclimate conditions included air temperature, humidity, wind speed, and temperature index humidity (THI). Air temperature and humidity were measured using a hygrometer with a duration of 3-5 minutes. The wind speed was measured by using an anemometer with a length of observation of 1 minute. The temperature Humidity index was measured by using a wet and dry ball thermometer; the daily average temperature was obtained by using Handoko (1995) formulation. Then, THI calculation was done by using Amstrong (1994) equation:

$$\mathrm{THI} = \mathrm{Dbt} + \left(0.36 \cdot (\mathrm{Wbt})\right) + 41.2$$

Information:
THI = Temperature humidity index (°C)
Dbt = dry ball temperature (°C)
Wbt = wet ball temperature (°C)

Measurements were taken three times a day, 7:00 in the morning, 12.00 day, and 17:00 afternoon (Western Indonesia Time).

b) Physiological responses

Measurement of physiological responses in this study included measures of respiratory frequency, pulse rate, and rectal temperature. Frequency respiratory was done by observing and calculating the frequency of movement of the ribs, abdomen, and chest cavity. The rate of respiration was calculated based on the number of respirations in 1 minute. The pulse measurement was done by attaching the hand. It was the artery of *coccygea*l under the middle of the tail more than 10 cm from the anus (Kelly, 1984). Measurements were made for 1 minute. Rectal temperature was measured by using a digital clinical thermometer that was inserted in the rectum as deep as ± 5 cm for 1 minute or until the clinical thermometer made a sound for the measurement of physiological responses carried out three times a day, namely the morning at 07.00, the afternoon at 12.00, and the afternoon at 17.00 (Western Indonesia Time).

c) Leukocyte differential

Leukocyte differentiation testing was done by taking blood directly at two study sites. The collected blood from each animal was put directly into the EDTA-K3 vacuum tube (China). The tunnel was closed by using a plug and labeled according to treatment. Leukocytes and leukocyte differentials were calculated by using a microscope (Nikon Ys 100). The Stress Index calculation was done by using a comparison of neutrophils and lymphocytes (N/L) (Kannan et al., 2000).

4. Data Analysis

This study used two analyzes, for microclimate conditions and physiological responses used a completely randomized design of factorial patterns of 2 x 3 with five replications. The first factor was two levels of maintenance system treatment: the influence of the location of wet peatlands and the location of dry peatlands. In comparison, the second factor was three levels of observation time, namely observation in the morning, afternoon, and evening. The average difference between treatments that occurred next was the least-squares means test according to Kaps & Lamberson (2004), with the mathematical model as follows:

$$y_{ijk} = \mu + t_i + \alpha_{ij} + t_k + (t^*t)_{ik} + \varepsilon_{ijk}$$

Information:
Yijk = microclimate conditions/ physiological responses
μ = general average
t*i* = the influence of the research location to-*i*
αij = the influence of the research location to observation time
tk = the influence of observation time
(t*t) *ik* = interaction between research location to -*i* and observation time to -*k*
Ɛijk = observation error

Whereas the differential measurement of leukocytes was observed in the experimental unit (cattle) the location of the wet peatland and the location of the dry peatland, so that it was analyzed using the unpaired t-test with a mathematical model as follows:

$$t_{hit} = \frac{M_1 - M_2}{\frac{\sqrt{ss_1 + ss_2}}{n_1 + n_2 - 2}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

Information:
M_1 = average score of wet peat locations
M_2 = average rating of dry peat locations
ss_1 = *sum of square* wet peat locations
ss_1 = *amount of square* dry peat locations
n_1 = number of wet peat locations samples
n_2 = count of dry peat locations samples

C. Result and Discussion

1. *General Situation of Research Location*

a) Geographical location

Central Kalimantan is one of the provinces that is crossed by the equator. So that, it gets solar radiation ranging from 25.80 to 72.20%, rainfall ranges from 76-476 mm, air temperature ranges from 21-35.60 ° C with an average of 27.10-27.90 ° C, air humidity ranged from 43-100% with an average of 79.10-86.90%, wind speeds ranged from 3.70-5 knots, from January to December 2016 (BPS Pulang Pisau Regency, 2016).

This area has quite extensive peatlands. Ritung et al. (2012) suggested that the broadest distribution of peat in Kalimantan was in Central Kalimantan Province, with an area of 2,659,234 hectares or 55.66% of the total area of Kalimantan's peat. It was further explained that the peatland ecosystem was particular with conditions that were always waterlogged, fragile, less fertile, and irreversible.

b) Climate conditions of research location

In this study, microclimate conditions were seen through; air temperature, humidity, temperature-humidity index (THI), and wind speed. The average air temperature, humidity, temperature humidity index (THI), and wind speed in the wet peatland and dry peatland categories were shown in (Table 1).

Table 1. Climate conditions of research location

Parameters	Location	Observation time		
		Morning (07.00)	Day (12.00)	Afternoon (17.00)
Temperature(°C)	Wet peat	28.81 ± 1.76	37.04 ± 2.56	30.94 ± 2.48
	Dry peat	26.91 ± 0.56	33.74 ± 2.47	29.50 ± 1.82
Humidity (%)	Wet peat	81.40 ± 6.74^{b}	56.93 ± 9.45	84.13 ± 2.72
	Dry peat	91.87 ± 2.32^{a}	63.60 ± 0.26	84.39 ± 9.16
THI (THI)	Wet peat	78.69 ± 1.10^{a}	86.34 ± 2.00	82.08 ± 2.95
	Dry peat	75.96 ± 0.64^{b}	83.55 ± 2.25	80.09 ± 2.69
Wind Speed (m/s)	Wet peat	0.55 ± 0.15^{a}	1.32 ± 1.98	0.84 ± 0.59^{a}
	Dry peat	0.16 ± 0.24^{b}	1.18 ± 0.46	0.16 ± 0.24^{b}

Different superscript letters in the same row show significant differences (P<0.05)

Different geographical conditions from wet peat caused the low air temperature on dry peat. On drained peatlands around the cage were filled with tall trees. The sun's radiation around the cage was blocked as the opinion of Tyasyono (2004), which stated that several factors influenced air temperature. Including the amount of radiation received per year, per day, per season, the influence of land or sea, influence of altitude, indirect wind effect, the influence of latent heat, type and ground cover, the impact of the angle of incidence of sunlight. The air temperature was one of the factors that influenced the appearance of Bali cattle production because it could affect the heat balance in the body of cattle. The study results indicated that the air temperature in both study locations fluctuated, the morning air temperature increased during the day and then decreased in the afternoon.

Humidity was the amount of moisture in the air. The relative humidity figure was from 0-100%, which means 0% dry air, while 100% means that the air was saturated with water vapor and water points' occurred. Relative humidity (R.H.) was the ratio between actual (measured) water vapor pressure and water vapor pressure under saturated conditions (Lakitan, 1994). The results showed that the morning humidity observed in wet peatlands was lower and statistically different (P <0.05) compared to dry bogs (Table 1). The difference in moisture between study sites was influenced by air temperature and wind speed.

Low air temperatures caused the high morning humidity on the location of dry peat. Yani et al. (2013) stated that the smaller the air temperature in a livestock stable, the higher the humidity was. Another factor that affected moisture was air movement, the faster the air circulation, the faster the humidity would be decreased. The same opinion was stated by Nuriyasa et al. (2010). The amount of relative humidity measured in the cage depended on the source of water vapor in the cage, wind speed, and air temperature as a controlling factor for the evaporation rate.

The temperature-humidity index (THI) was the balance between air temperature and humidity. According to Nuriyasa (2015), THI was one indicator of the comfort level of livestock; the higher the THI value of the optimum range, the higher the heat stress experienced by animals. The temperature-humidity index (THI) on morning observations on dry peatlands was statistically different compared to wet bogs (P <0.05). The temperature-humidity index (THI) was closely related to the increase in air temperature and humidity. Aritonang et al. (2017) stated that Bali cattle's comfort zone was at a THI value ≤ 74 above 75, which was a dangerous zone for Bali cattle. Stress levels that could be accepted by ruminants were calculated using the THI value could be seen in (Table 2).

Table 2. Category of temperature-humidity index

(THI value)	heat stress category
≤ 74	Normal
75-78	low stress
79-83	medium stress
≥ 84	heavy stress

Source: Bulitta et al. (2015)

Based on the normal range of THI values suggested by Bulitta et al. (2015), It could be classified that the parent Bali cows that were kept in wet peatland in the morning were categorized as mild stress, heavy daytime stress, and afternoon moderate stress. While the parent Bali cows were on the dry bog in the morning, experienced mild anxiety, daytime and afternoon stress was moderate. There was an indication of the threat of pressure in the two different peat locations, so there was a strategy as a form of anticipation going forward. Improvements could be made based on the advice of Velasco *et al.* (2002) through improved enclosure circulation, feed management, nutritional balance, and *ad libitum* drinking water.

The wind was the movement of air due to differences in pressure. The results showed that the wind speed in the dry peatlands, which observed in the morning and evening, was lower and statistically different (P <0.05) compared to the wind speed in the wet bog (Table 1). Wind speed was closely related to the height of the place, the higher land, and the faster the wind's movement in the air.

Wind speed was one of the leading indicators in heat release in the body of livestock; high wind speeds helped reduce heat stress for animals, especially during the daytime. It was consistent with the opinion of Yani & Purwanto (2006) that wind could be used to help release heat and reduce heat stress in livestock. The wind speed in this study fluctuated.

2. *Physiological Response of Reared Bali Cattle*

The physiological response was a picture of livestock comforted in producing optimally to the influence of the internal environment and stress obtained from the external environment. Bali cattle's physiological response in this study included; rectal temperature, pulse, and respiratory rate (Table 3). Heat conditions above normal that were affected by temperature, relative humidity, wind speed, and radiation intensity could change the heat reception load, thereby affecting performance, reducing the comfort level of livestock, and causing death (Mader *et al.*, 2006). Furthermore, Yani *et al.* (2013) stated that heat stress in Bali cattle resulted in the conversion of feed. Which was consumed by cows used to reduce stress so that the primary purpose of feeding to increase body weight was disrupted because some of the feed consumed was used to reduce heat.

a) Respiratory frequency

Respiratory frequency was the intensity of entering and releasing oxygen in the body of each microorganism. The respiratory rate of reared Bali cattle on wet peatland morning observations was lower and statistically different (P <0.05) compared to raised Bali cattle on dry peatlands. Respiratory frequency was the first response to livestock due to stress obtained from the external environment and the result of excess heat produced from metabolic processes. Bali cattle's high respiratory frequency in dry peatlands along with the increase in THI. The average value of THI morning 78.69, daytime 86.34, and in the afternoon 82.08 (Table 1). Aritonang et al. (2017) stated that the comfort zone of Bali cattle at THI values ≤ 74 above 75 was a dangerous zone for Bali cattle. High-temperature humidity index (THI) would be responded to by increasing livestock breathing frequency. It indicated that reared Bali cattle in dry peatlands respond to significant environmental changes only by breathing rate. It is in contrast to bred Bali cattle raised in wet bogs that react to environmental changes by increasing pulse and rectal temperatures higher than reared Bali cattle on dry peatland.

The respiratory frequency of daytime observations on dry peatlands was higher with the results of research obtained by Aditia *et al.* (2017) with microclimate climatic conditions of maintenance of Bali cattle at THI 84.03 daytime observations were obtained respiratory frequency 25 times minutes/minute. Furthermore, Suretno's research (2016) compares Balinese cattle and other crossbreeds with microclimatic conditions at THI 84.23 during the rainy season and daytime observations in Central Lampung regency. It was obtained respiratory frequency of 21.92 Bali cattle, Ongole crossbreed cattle 19,74, Limousin crossbreed cattle 20.90, and Simental crossbreed cattle 20.88 times/minute. It is indicated that the frequency of breathing in peatlands during the day was higher compared to other crossbred cattle seen from the response of livestock through respiration. This difference was due to different environmental conditions between study sites. The respiratory rate at both study sites was still in the normal range. The average frequency in adult cattle was 15-35 times per minute and 20-40 times /minute in calves (Jackson in Serang, 2016).

Kelly (1984), the respiratory frequency was influenced by several factors, including body size, age, physical activity, anxiety, air temperature, pregnancy, disturbance in the digestive tract, animal health conditions, and animal position.

b) Pulse frequency

The frequency of the pulse was a picture of the heart's performance. The increase and decrease in pulse frequency were closely related to the heat load, which was produced both in the metabolic processes in the body of livestock, and the heat load was received from the external environment. The frequency of the pulse was influenced by factors of age, body size, environmental conditions, measurement time, and livestock activity (Dwatmadji *et al.,* 2000). The results showed that the pulse frequency of the reared Bali cattle in the wet peatlands was higher and statistically different observations during the day (P <0.05) with the raised Bali cattle in the dry bog (Table 3).

Table 3. Physiological responses of Balinese cattle on wet peat and dry peatlands

Parameters	Location	Observation time		
		Morning (07.00)	Day (12.00)	Afternoon (17.00)
R.F. (time second^{-1})	wet peat	21.26 ± 2.59[b]	25.66 ± 2.99	24.91 ± 2.70
	Dry peat	24.88 ± 2.45[a]	26.68 ± 2.76	24.61 ± 1.90
DN (time second)	wet peat	57.15 ± 6.33	64.57 ± 5.01[a]	61.60 ± 6.17
	Dry peat	55.14 ± 3.58	57.09 ± 5.53[b]	58.61 ± 4.73
RT (°C) (SR(°C))	wet peat	37.83 ± 0.23	38.48 ± 0.29	38.64 ± 0.33[a]
	wet peat	37.92 ± 0.18	38.35 ± 0.23	38.30 ± 0.23[b]

Different superscript letters in the same row show significant differences (P<0.05). S.R.: Rectal temperature, D.N.: Pulse, FP: Respiratory frequency

The high pulse of reared Bali cattle in wet peatlands was in line with the increase in air temperature, morning air temperature 28.81, daytime 37.04, and afternoon 30.90 (Table 1). The high air temperature was responded by livestock, one of which was by increasing the pulse rate as a thermoregulation effort. An increase in the pulse frequency was the response of the livestock body to spread the received heat into colder organs (Anderson, 1983). Anton *et al.* (2016) physiological changes of Bali cattle breeding transported from Lombok to West Kalimantan with the temperature of the paddock in the ship 28.83 °C obtained a pulse before transportation 69.00 and after transportation 77.25 times/minute. It indicated that the reared Bali cattle in wet peatlands were more adaptive to higher temperatures. Figures in this study were still in the normal range; the regular pulse in beef cattle ranged between 36-80 times/minute (Frandson, 1992).

Compared with other cattle nations, the study of Panjono & Baliarti (2009) with the condition of the microclimate of the study site at 31.50 daytime temperatures on Ongole crossbreed cattle was obtained a pulse rate of 76.83 times/minute. It showed that Bali cattle in wet peatland observations in the afternoon were far more adaptive than Ongole crossbreed cows with almost the same temperature conditions. Another factor influencing the increase in pulse rate was the high eating activity caused by metabolic activity in the body to increase so that the pulse rate increased to reduce heat in the body by Naiddin *et a*l. (2010).

c) Rectal temperature

Rectal temperature was a reflection of the balance of heat produced with heat released. The obtained rectal temperature did not indicate the total heat generated by the body but showed a balance between heat production and body heat expenditure (Kelly, 1984). The results of observations of rectal temperature in wet peatlands had increased in the morning and afternoon until afternoon observations, but in dry, they fluctuated bogs. The observed rectal temperature in the afternoon on drained peatlands was lower and statistically different (P<0.05) compared to wet peatlands. Rectal temperature was closely related to feeding consumed, livestock activity in cages, wind movement, humidity, THI, and air temperature.

The high rectal temperature of the reared Bali cattle in wet peatlands was due to top THI, morning THI value 78.69, daytime 86.34, and evening 82.04 (Table 1). High-temperature humidity index (THI) was responded by one of them by increasing rectal temperature. Compared with the results of Saiya's study (2014) in Balinese cattle in Merauke Regency based on the season with THI 81.34 conditions, the rectal temperature value was 38.70 in the West and 38.46 ^{o}C in the east season. It indicated that the raised reared Bali cattle on wet peatlands were more adaptive than the Bali cattle raised in Merauke Regency in the west season.

The results of this study different from the effects of Suretno's research (2016), which compared Bali cattle with other crossbreeds with microclimate conditions at 84.23 THI in the rainy season during the daytime observations in Central Lampung regency was obtained rectal temperatures of 38.26 Bali cattle. Ongole crossbreeds cattle 38.35, Limousin crossbreed cattle 38.25, and Simental crossbreed cattle 38.47. It indicated that Bali cattle were more adaptive compared to Ongole crossbreed cattle, and Simental crossbreed cattle in Central Lampung Regency with the same environmental conditions. Compared with the results of this study, observations during the day on wet peat showed that rectal temperatures were higher than rectal temperatures in other crossbred peoples; this was due to different environmental conditions between locations. However, the results of rectal temperature measurements in the reared Bali cattle were kept based on various characteristics of peat that were still in the normal range. Hansen (2004) explained that cattle's average temperature in the tropics was in the field of 38-39.2 ºC.

3. Differentials of Bali Cattle's Leukocytes

In general, the leukocyte differential was divided into two, namely granulocytes and agranulocytes. Granulocytes were split into three, namely neutrophils, eosinophils, and basophils. In contrast, agranulocytes were divided into two, namely lymphocytes and monocytes, but this study only looked at neutrophils, lymphocytes, and the ratio between neutrophils and lymphocytes. Neutrophils were also the primary defense against the presence of foreign objects that entered the body's tissues (Samuelson, 2007). Lymphocytes were leukocytes that responded to antigens by forming antibodies circulated in the blood or the development of cellular immunity (Frandson, 1992). Lymphocytes were also said to be the dominant leukocytes in ruminants. The ratio between neutrophils and lymphocytes was one indicator to determine Bali cattle experienced stress. The average neutrophils, lymphocytes, and the rate of neutrophils to lymphocytes were shown in (Table 4).

Table 4. Neutrophils, lymphocytes and N/L ratios Bali cattle on different peat Characteristics.

Parameters	Location	
	Wet peat	Dry peat
Neutrophils(%)	49.35 ± 12.91^{a}	33.53 ± 11.92^{b}
Lymphocytes (%))	42.35 ± 13.55^{b}	57.77 ± 13.22^{a}
N/L ratios	1.41 ± 0.94^{a}	0.67 ± 0.45^{b}

Different superscript letters in the same row showed significant differences (P<0.05).

The results showed that the number of neutrophils of Bali cattle raised in wet peatlands was higher and statistically different ($P<0.05$) compared to neutrophils of Bali cattle that were kept on the dry bog. It difference was due to the higher air temperature on wet peat compared to drained peatland, the morning air temperature in wet peatland was 28.81, daytime 37.04, and the afternoon was 30.94 ^{o}C, whereas on dry peat morning air temperature was 26.91. Daytime 33.74, and in the afternoon, 29.50^{o}C (Table 1). High air temperatures in wet peatlands caused neutrophils to increase. The function of neutrophils themselves was to respond to environmental temperatures (Mashaly *et a*l., 2004). An increase in the number of neutrophils could occur due to neutrophils digested in the foreign body, then experienced autolysis, and released the degraded substances into the lymphatic tissue (Lee et al., 2003). Lymph tissue secreted histamine, which stimulated the bone marrow to release neutrophil reserves, so that neutrophil production increased (Lestari *et al.* 2013). The research results of Adnyani *et al.* (2018) obtained a percentage of the number of neutrophils of Bali cattle was kept based on the altitude of Nusa Penida at 19.4%.

Lymphocytes were leukocytes that respond to antigens by forming antibodies circulated in the blood or the development of cellular immunity (Frandson, 1992). The results showed that the number of lymphocytes of reared Bali cattle in wet peatlands was lower and statistically different ($P<0.05$) compared to Bali cattle that were kept on dry bogs. Increased lymphocytes occurred when antigens entered the body, so the body must produce antibodies (Frandson 1992). Decreased lymphocytes could be experienced if there was immunosuppression or damage to lymphoid tissue due to certain factors or livestock were in heat stress from the environment. When compared with the results of Utama *et al.* (2013), the percentage of lymphocytes in Bali bovine cattle in Bali was 47.6%. It indicated that the reared Bali cattle raised on wet peat were lower, while the bred Bali cattle raised on dry peatlands were higher. The standard reference value for the percentage of livestock was lymphocytes 45-75% (Pawitri *et al.*, 2014).

The ratio between the number of neutrophils and lymphocytes (N/L) maintenance of reared Bali cattle based on different peat characteristics was shown in (Table 5). N/L ratio was one indicator to determine which animals were stressed. Based on the results of this study showed that the reared Bali cattle in the dry peatland was significantly ($P<0.05$) lower than the Bali cattle that were kept in the wet bog, the percentage value of N/L in the wet peatland was 1.41, while in the dry peatland was 0.67. This difference was due to different environmental conditions in the two study sites, the temperature of wet bogs in the morning was 28.81, daytime 37.04, and afternoon 30.94^{o}C. In contrast, in dry peatlands, the morning temperature was 26.91, daytime 33.74, and evening day 29.50^{o}C (Table 1). It caused the reared Bali cattle raised on wet peat to respond to rising temperatures, especially during the day. An increase was in environmental temperature caused an increase was in neutrophils, and a decrease was in lymphocytes; this was evident in the maintenance of Bali cattle in wet peat, an addition was in neutrophils, and a reduction was in lymphocytes.

Bali cattle were thought to experience stress. They had a high number of neutrophils (neutrophilia) and low lymphocytes (lymphopenia). The causes of stress in animals were caused by environmental factors and the presence of parasitic disorders. According to Kannan *et al.* (2000), animals experienced stress if the N/L ratio was above 1.5. It indicated that the percentage of the amount of N/L in this study, both Bali cattle raised on wet peat and dry peat, was still reasonable.

D. Conclusion

The results indicated that the morning microclimate environment on wet peatlands showed differences in humidity, THI, and wind speed compared to dry bogs. The difference in microclimate between two locations in the afternoon was only occurred at wind speed. Differences in microclimates in wet peatlands and drained peatlands provided different physiological responses to morning breathing frequency, daytime pulses, rectal temperatures, and afternoon leukocytes. However, Balinese cattle's physiological response was still at normal levels in wet peatlands and land dry peat.

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