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PHYSIOLOGICAL STATUS OF SHEEP REARED INDOOR SYSTEM UNDER THE TROPICAL RAIN FOREST CLIMATIC ZONE

Agik Suprayogi[1], D.A. Astuti[2], F. Satrija[1] and Suprianto[3]
1) Faculty of Veterinary Medicine, Bogor Agricultural University, IPB Darmaga-Bogor-16680, Indonesia, Phone/Fax: 0062-251-629462, email:asupray@yahoo.com
2) Faculty of Animal husbundry, Bogor Agricultural University, IPB Darmaga-Bogor
3) Faculty of Forestry, Bogor Agricultural University, IPB Darmaga-Bogor

ABSTRACT

The objective of the study was to evaluate the physiological status of sheep reared indoor system under the tropical rain forest climatic zone in the *Gunung Walat Education Forest-Bogor Agricultural University,* Sukabumi-West Java-Indonesia. Twenty Javanese thin-tailed ewes, average body weight of (24.5 ± 2.6) kg,were reared indoor system and fed twice a day with mixgrass plus soybean curd waste and watered *ad libitum*. Monitoring of stable humidity and temperature were conducted continues over 24 hours. Measurement of hearth rate, respiration rate, and body temperature of were carried out in the morning and afternoon. This study revealed that the average availablelative humidity in the stable of HPGW-IPB was (96.40 ± 6.95) %. The average temperature was (22.64 ± 1.25) °C. The consequence of bioclimatic condition directly affected to the physiological status of the ewes, such as hearth rate was (75.50 ± 5.45) beat/min, respiration rate was (29.75 ± 3.15) inspiration/min and body temperature was (38.85 ± 0.25) °C. The average of relative humidity a day in the stable was uncomfortable for the animal health and production system. The high humidity affects enhancing the respiration rate of ewes, although hearth rate and body temperature was still in the ranges of the normal physiological values. The bioclimatic condition was dominantly influenced by density and diversity of vegetation in the tropical rain forest.

Keywords: animal physiology, sheep, and tropical rain forest

INTRODUCTION

Now days, a kind of agribusiness have already been utilized in the natural resource of the forest area as an attempt to enhancing its added values, as a new strategy to overcome the national crisis of food and industry material in Indonesia. The forest landuse management has to be encouraged to lead the national economic growth and also to maintain sustainability of forest natural resource. One of forest land use management was Agrosilvo pastural (ASP) system. ASP system was the forest land use management which integrates forest wood, crop and animal production. The integration has to be maintained to attempt the gain of sustainable productivity and the most important it should be mutual and synergistic interaction to maintain the sustainable environment (Buck *et al.*, 1999).

The existence of the animal production activities in the forest environment has to be paid an attention due to the consequence of possible environment stress occurred. Nevertheless, the existence of animal could maintain the sustainability of agriculture and forest production through the utilization of animal excreta. A-biotic environment

were the key factor of emerging physiological stress on the animal, especially temperature, humidity, rain fall (Yousef, 1984; Chantalakhana and Skunmun, 2002), wind, and sun radiation (Randall 2002).

Animal production activities using the ASP system have to be focused on the maintaining of environment condition as a comfortable climate for animal (Singh, 2003). Optimum sheep productivity in the tropical region are that the rare of the temperature 13^0C – 18^0C and relative humidity of 60 - 70% rel. (Dowell, 1972). The range of effective environment temperature that an animal can be reached optimum productivity without changing its basal metabolism to maintain constant body temperature (Thermoneutral Zone) is 10^0C – 20^0C (Collier 1985) and critical temperature with decreasing feed intake and milk yield in cattle are above 30°C (Dowell, 1972). Williamson and Payne (1977) reported that the ideal microclimate for livestock in the tropic was temperature 18^0C – 21^0C and relative humidity of 50% – 60%. Problems of health and production in the tropic area occasionally emerge on the suffering animal were caused by heat and humidity stress (Singh 2003). It could be understood that microclimate in the tropical region could influence the physiological condition of the animal. French (1970) stated that sheep and goat placed in the heat stress environment for long time could affect the thin performance, it caused by reduce body fat and fall of fur and that sheep and goat have high tolerance on the extremely change of environment temperature in range of 30°-40°C. Body temperature regulation on the mammalian and poultry are always controlled under constant level (homeotermis) for maintaining optimal physiological condition (Sturkie, 1981). The homeiotermis could be meintained due to the balancing of metabolism heat production and heat loss to the environment (Cunningham, 2002). Air temperature and solar radiation affect the ability of animal to lose heat by convection, conduction, radiation; while relative humidity influences evaporative heat loss (Coiller, 1985).

The *Gunung Walat Education Forest-Bogor Agricultural University* (HPGW-IPB), located in Sukabumi-west Java-Indonesia on the 726 m above sea level altitude, with the kind of planted and wild canopy forest vegetation. *Agathis lorantifolia* (damar), *Pinus merkusii* (tusam), *Schima wallichii* (puspa), and *alpingia excelsa* (rasamala) were available dominant plantation in HPGW (Eli, 2002). The altitude and available vegetation condition in HPGW lead to influence the microclimate of the region because of high level of sun radiation was absorpted in the region (Yousef, 1984). Establishment of animal production system in the region pastures (outdoor) or caged (indoor) system had certain consequence in relation to the influencing of the physiological status and animal health.

The objective of the study was to evaluate the physiological status of sheep reared indoor system under the tropical rain forest climatic zone in the *Gunung Walat Education Forest-Bogor Agricultural University,* Sukabumi-West Java-Indonesia, using measurements of hearth rate, respiration rate, and body temperature parameters.

MATERIALS AND METHODS

The measurement of parameter such as hearth rate, respiration rate, and body temperature were conducted to the 20 Javanese thin-tailed ewes which average body weight of (24.5 $\pm$ 2.6) kg. Simultaneously, the measurement of climatology dates also was executed in HPGW region on day and date of 19.03.2005. All sheep were caged in the indoor system approximately 75 m^2 wide surrounding of canopy forest vegetation

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such as *Agathis lorantifolia* (damar). This stable is made by concrete wall and flour, corrugated asbestos roof, and approximately 3.25 m high from flour to the roof. Sheep were fed with 60% of mix grass and 40% of soy bean curd waste in different amount depend on body weight.

Measurement of physiological parameters

Physiological parameter of hearth rate (beat/minute), respiration rate (inspiration/minute), and body temperature (°C) were measured using stethoscope to calculate hearth beat sounds per minute, movement of thorax wall, and body thermometer respectively in this study. The measurement was carried out two times a day in the morning (08.00 – 09.00) and in the afternoon (17.00 – 18.00).

Measurement of climatology parameters

Two important parameters such as environment temperature (°C) and relative humidity (%) in the indoor system (inside of stable) and outdoor system (outside of stable) were measured using automatic termo-hygrograph for 24 hours. Recorded graphs obtained was analyzed and calculated to know the averages of temperature and humidity per day.

RESULTS AND DISCCUSION

This study reveals that heart rate and body temperature on sheep reared indoor system in HPGW region were still in the normal range of physiological status which respectively is (75.50 ± 5.45) beat/min and (38.85 ± 0.25) inspiration/min. Otherwise, abnormality of respiration rate values of the sheep occurred in this study, which the respiration rate shows an increase above level than normal values is (29.75 ± 3.15) inspiration/min. The physiological status of sheep reared indoor system in HPGW region can be seen on Table 1.

Table 1. The physiological status of sheep reared indoor system in HPGW region

Physiological Parameter	Values of Sheep in HPGW	Normal Values of Sheep*
Heart Rate (beat/min)	75.50 ± 5.45	70 - 80
Respiration (inspiration/min)	29.75 ± 3.15	15 - 25
Body Temperature (°C)	38.85 ± 0.25	39,2 - 40

*: Smith and Mangkoewidjojo (1988)

The physiological status of sheep had a closely interaction to the microclimate of the region. The microclimate in HPGW region were measured in the indoor system (inside of stable) and outdoor system (outside of stable), were extremely in above level from ideal humidity for animal in the tropic, were (96.40 ± 6.95)%. and (94.92 ± 8.07)% respectively. The environmental temperature which indicate the slightly above level from thermoneutral zone, respectively (22.64 ± 1.25)°C in the indoor system and (26.24 ± 2.44) °C in the outdoor system. The microclimate of HPGW compared to the thermoneutral zone and ideal humidity for animal in the tropics showed in the Table 2.

Considering of the physiological status and microclimate condition, the respiration rate abnormality occurring on the indoor sheep could be caused by high humidity level in the HPGW environment. Therefore the vapor pressure gradient were

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limited, consequently it influences evaporative heat lose (Coiller, 1985). According to the homeiotermis for maintaining optimal physiological condition, the respiration rate had to be increased. Air temperature in the HPGW was still convenience for survival especially in the indoor system, although the temperate showed the slightly above level than thermoneutral zone. In the HPGW microclimate condition, the sheep reared indoor system extremely suffering by humidity stress and its reveal the uncomfortable for enrichment productivity. The high humidity level in HPGW could be occurred might be as a consequence of density and diversity of vegetation in HPGW tropical rain forest.

Table 2. The microclimate condition in HPGW compared to the thermoneutral zone and ideal humidity for animal in the tropic

Bioclimatology Parameter		Values in HPGW	Thermoneutral Zone	Ideal Humidity in the Tropic
Indoor System	Temperature (°C)	22.64 ± 1.25[a]	(18 – 21)[2]	(60 – 70)[1] (50 – 60)[2]
	Relative Humidity (%)	96.40 ± 6.95[a]		
Outdoor System	Temperature (°C)	26.24 ± 2.44[b]		
	Relative Humidity (%)	94.92 ± 8.07[a]		

Means with different superscripts (a, b) in the same column are significantly different (P<0.05)
[1]: Dowell (1972)
[2]: Williamson and Payne (1977)

CONCLUSION

Physiological status of sheep reared indoor system in the tropical rain forest (HPGW) environment showed the extremely suffering by humidity stress. The high humidity in the stable affected enhancing of respiration rate of the sheep, although the hearth rate and body temperature tended to the normal physiological value. The microclimate condition indicated the uncomfortable for enrichment productivity on the animal production system, nevertheless the average humidity and temperature in the sheep reared indoor system still convenience for survival. The condition was dominantly influenced by density and diversity of vegetation in the tropical rain forest.

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