Physiological status naturally infected gastrointestinal goats in response to polyherbal supplementation and *Melastoma malabathricum* extract

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Abstract. This study aimed to determine the effect of polyherbal supplementation and *Melastoma malabathricum* extract on the physiological status of naturally infected gastrointestinal parasite on Peranakan Etawa goats. Twenty goats were divided into five treatments, in which four treatments were infected animals and one treatment was used as an uninfected control animal. The five treatments were: T1= Non-polyherbal pellets + Ivermectin, T2= *Andrographis paniculata* + *Curcuma mangga* + *Nigella sativa*, T3= *Andrographis paniculata* + *Curcuma domestica* + *Nigella sativa*, T4= *Curcuma mangga* + *Curcuma domestica* + *Nigella sativa*, and T5= Uninfected control + Non-polyherbal pellets. *Melastoma malabathricum* extract was also given to T2, T3, and T4 to substitute Ivermectin. Parameters measured were rectal temperature, respiration rate, pulse rate, HTC, and THI. Results showed that there was no significant difference among the treatments on respiration rate, but highly significant (p<0.01) on rectal temperature and pulse rate. The pulse rate was significantly higher (p<0.05) in uninfected animals having THI value of 77-86 representing the hot condition for goats. Those goats could adopt its environment during the study as indicated by the HTC value of 2.15-2.28. Results also showed that HTC value was strongly correlated with the respiration rate (coefficient correlation 0.9987).

1. Introduction

Goats quite susceptible to different kinds of stress i.e., physical problems, unbalancing the nutrition chemical exposure, psychological response, and heat stress. Between the pressures, heat stress is considered the most common problem in climatic conditions [1][2]. Heat or warmth stress, therefore, need more concern, due to the change of environmental temperature will affect animal health and production [3][4][5]. Under humid, warm, and moist environments like Bengkulu very favorable for the development of eggs and survival gastrointestinal parasite living stage. Gastrointestinal parasite, especially *Haemonchus contortus* is arguably the most pathogenic gastrointestinal parasite infecting the goats' population all over the world [6][7][8][9]. Environmental factors such as the agro-ecological farming system, animal husbandry activities play an essential role in the prevalence of gastrointestinal infestation [10]. The other risk factors are rainfall pattern, soil moisture, sex, age, Body Condition Score, genotype, as well as parasite or worm population [11][12][13][14]. The system in goats against infectious agents involved in the regulation of these physiological functions such as body temperature, the rate of respiration, and heart rate, or pulse rate.
The standard methods for control of gastrointestinal parasites are treated with synthetic anthelmintics. However, alternative strategies such as the use of medicinal plants have been reported [15][16]. As the preference of *Haemonchus contortus* was in the abomasum, therefore nutrition manipulation can be used as a complementary method to control gastrointestinal parasites. Our previous research found that Palm Kernel Cake supplementation combines with 125 mg extract of *Melastoma malabathricum* per live weight every week had a positive effect on the average daily gain of infected Kacang goats [16]. However, when the level of extract increases 250 mg/kg live weight a week, average daily gain decline significantly.

Scientists have been involved in evaluating the possible use of herbs or plants for feed supplement and medicinal herbs/plants. *Andrographis paniculata* traditionally has been used as anti-malaria, anti-inflammation, etc. Scientific evidence showed that *Andrographis paniculata* has been demonstrated different modes of biological action either in vivo or in vitro, especially as antimiycobacterial, antiviral, anti-inflammatory, and immunomodulatory [17]. The other herb that has potential as a feed supplement is *Curcuma longa*. The addition of *Curcuma longa*, *Nigella sativa* in the mix-herbal supplement block increases the average daily gain of Bali cattle [18]. Wanapat *et al.* [19] reported the improvement of rumen fermentation on beef cattle due to feeding supplementation with lemongrass alone or mixed with other herbs (peppermint and garlic powder). This research was carried out to determine the impact of polyherbal supplementation and *Melastoma malabathricum* extract on the physiological status of naturally infected gastrointestinal parasites in female Peranakan Etawa (PE) goats.

2. **Research methods**

2.1. **Study site experimental animal**

The research was completed in Animal Science Laboratory University of Bengkulu and experimental station in Babatan Seluma Bengkulu about 24 km from University (-35.9018300 latitude and 102.360022 longitudes). During adaption and the observed period from March to May 2020, all goats were maintained individually in constructed pen and feed with fermented oil palm sludge and cassava leaves, rice bran, + tofu waste. Water was provided *ad libitum* to all goats every day using a 5 L plastic pail.

2.2. **Experimental animal**

Twenty (20) PE female goats 7-8-month-old with BW 16.49 + 2.11 were assigned to this study. All goats were grouped into five treatments, consisting of four goats each, in which four treatments (T1, T2, T3, T4) had naturally acquired with a gastrointestinal infection. In contrast, one treatment (T5) was used as an uninfected control animal. The five treatments were: T1= Non-polyherbal pellets + single dose of Ivermectin, T2= Polyherbal pellets containing the combination of *Andrographis paniculata + Curcuma mangga + Nigella sativa*, T3= Polyherbal pellets (*Andrographis paniculata + Curcuma domestica + Nigella sativa*), T4= Polyherbal pellets (*Curcuma mangga + Curcuma domestica + Nigella sativa*), and T5= Uninfected control + Non-polyherbal pellets. *Melastoma malabathricum* extract was also given to T2, T3, and T4 to substitute Ivermectin. All goats were maintained individually in 140 × 80 cm caged for 56 experimental days, with the adaptation period for seven days.

2.3. **Feed composition**

| Nutrient composition (%) fresh weight | T-1 | T-2 | T-3 | T-4 | T-5 |
|-------------------------------------|-----|-----|-----|-----|-----|
| Molasses                            | 50  | 50  | 50  | 50  | 50  |
| Cassava Flour                       | 200 | 200 | 200 | 200 | 200 |
| Salt                                | 50  | 50  | 50  | 50  | 50  |
Nutrient composition (%) fresh weight

| Mineral mix       | T-1 | T-2 | T-3 | T-4 | T-5 |
|-------------------|-----|-----|-----|-----|-----|
| PKC               | 200 | 200 | 200 | 200 | 200 |
| Rice bran         | 490 | 240 | 240 | 240 | 490 |
| *Nigella sativa*  | -   | 10  | 10  | 10  | -   |
| *Curcuma mangga*  | -   | 120 | -   | 120 | -   |
| *Andrographis panicula* | - | 120 | 120 | -   | -   |
| *Curcuma domestica* | - | -   | 120 | 120 | -   |
| Total (g)         | 1000| 1000| 1000| 1000| 1000|

Table 2. Nutrient content of the basal feed

| No.  | Feed             | Nutrient content (%) | DM  | OM  | CP  | CF  |
|------|------------------|----------------------|-----|-----|-----|-----|
| 1.   | Tofu waste product | 93.82                | 93.54| 20.31| 16.77|
| 2.   | Oil palm sludge  | 91.57                | 89.32| 13.74| 22.68|
| 3.   | Rice bran        | 91.07                | 87.00| 10.01| 14.60|
| 4.   | Cassava leaves   | 93.08                | 92.03| 24.68| 18.17|

Three different feeds were given to all animals in different schedule: a) 50-gram pellet containing 12.5 g polyherbal were given at 08.00, b) mixture of tofu waste product and rice bran (*ad lib*) were fed at 10.00, and c) fermented cassava leaves and oil palm sludge (*ad lib*).

2.4 Preparation *Melastoma malabathricum* Extract

The method uses to prepare *Melastoma malabathricum* extract based on [20] with modification. *Melastoma malabathricum* leaves were dried at room temperature for 5-7 days, then powdered using an electric blender. The ethanolic extract was prepared from 10 grams of *Melastoma malabathricum* powder put in a jar with 100 ml of 96% ethanol by maceration methods. The mixture was then kept in a dark place for 24 hours. The extract was filtered using Whatman filter paper. The purified extract is then distilled at 85°C for 4 hours and then stored in a refrigerator at 4°C. It will be implemented for the next analysis.

Methods by Shankar et al. [21] with slight modification were implemented to synthesis silver nanoparticles. The ethanolic leaf extract was challenged using 0.01 M AgNO3 (Silver nitrate) solution at room temperature. At first, a 100 mL aqueous solution of 1.0 X 0.01 M silver nitrate was prepared. The contents were mixed in the proportion of 1:9 of *Melastoma malabathricum* extract and AgNO3 solution in a reaction tube under constant stirring for 1 hour using a magnetic stirrer at room temperature. After mixing, the mixture was stored at room temperature for 24 hours. The mixture was given 100 ppm/live weight for goats in T-2-T-4.

2.5 Physiological Measurement

The respiration rate of goats was measured based on the flank movement, rectal temperature (C) was measured using a rectal thermometer by inserting the thermometer about 1 inch into the rectum until stable, and pulse rate (x/minute) was obtained by placing the index and middle fingers on the femoral artery.

2.6 Measurement of climatology parameters

Parameters climatology measured in this experiment were ambient temperature (C) and relative humidity (%). Those parameters were measured three times a day during the 56-day trial. Those data used to quantify the goats thermal comfort zone, with the following equation Thermal Humidity Index/ THI = (1.8 x T + 32) – [(0.55-0.0055 x RH) x (1.8 x T -26)] after Thompson dan Dahl (2012) [21]. Heat tolerance coefficient based on Thakare et al. [22]: HTC = (RT/39.44) + (RR/24).
Analysis of variance (ANOVA) was used to measure the effectiveness of treatments using SPSS Software version 16.1, when the means had significant differences in the level p<0.05 were further analyzed using DMRT.

3. Results and discussion
The mean of room temperature, relative humidity, and THI measured during the research were shown in Figures 1 and 2. The temperature was ranging from 26–33°C, while the relative humidity was 61–72% and THI was 77–86.

![Figure 1. Weekly measurement of humidity (%) and temperature (°C) recorded during seven weeks period and measured three times a day 8:00 AM, 12:00 AM, and 3:00 PM](image)

According to Dowell [24] also Lu [25], the comfortable environment for the goats is between 18°C to 30° [24], or 25° to 30°C [25]. Figure 1 showed that the temperature began to incline during daytime and reached its peak at 12:00, then decrease during the afternoon, while the air humidity showed an opposite pattern temperature. The average ambient temperature (AT) tends to higher when relative humidity was lower. Room/ambient temperature and the relative humidity were lightly above the thermoneutral zone for goats as the relative humidity ideal in the tropical areas 60-70% [23] or 75% [24].
Results showed that THI was 77-86, THI representing the ambient temperature and relative humidity to which the animal deal without considering other different elements like solar radiation, wind velocity, or the length of the animal exposure to these conditions. THI values not more than 72 mean that goats are not in stressful conditions. THI value of 72 to 78 indicating the goat in a stressful situation, and when the THI over 78, extreme distress occurred or in other word, animals were inadequate to control the mechanisms of thermoregulatory or their average temperature (Livestock and Poultry heat stress indices suggested by Agricultural Engineering Technology Guide, Clemson University, Clemson, Sc. 29634, USA). According to Bernabucci et al. [25], the tolerance to heat stress in goats better than in other ruminants because of the differences in morphology and physiology among these species. Those differences correlated with the mechanism in temperature reduction or heat dissipation. Besides, high environmental temperatures and relative humidity will affect ruminants production [26]. Popoola et al. [27] reported that THI would affect live weight and average daily gain on West African Dwarf (WAD) goats.

There was no effect of treatments on respiration rate, and the value is in the normal range. The respiration rate is a very sensitive indicator to determine animal heat stress [28]. Enhancing of respiration rate of the ewes could be due to the high humidity in the stable [29]. Our finding showed that polyherbal supplementation and Melastoma extract could decrease the detrimental effect of Haemonchus contortus infection. Table 3 showed that the rectal temperature on T3 significantly high (p<0.01). Our findings indicate that the goats in all treatments capable of maintaining their

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**Figure 2.** Weekly measurement of the temperature-humidity index (THI) recorded during seven weeks and measured at 8.00 AM, 12:00 AM, and 3:00 PM

| Physiology               | T1   | T2   | T3   | T4   | T5   | p-value |
|-------------------------|------|------|------|------|------|---------|
| Respiration rate (x/minute) | 28.14 | 28.71 | 31.21 | 28.29 | 29.71 | ns      |
| Rectal temperature (°C)  | 38.51 a | 38.58 ab | 38.70 b | 38.50 a | 38.46 a | 0.01    |
| Pulse rate (x/minute)     | 69.00 a | 69.29 a | 70.57 a | 68.86 a | 75.00 b | 0.001   |
| HTC                      | 2.15 | 2.17 | 2.28 | 2.15 | 2.21 | ns      |

Different superscript letters in the same rows indicated a difference statistically T1= Non-polyherbal pellets + single dose of Ivermectin, T2= Polyherbal pellets containing the combination of Andrographis paniculata + Curcuma mangga + Nigella sativa, T3= Polyherbal pellets (Andrographis paniculata + Curcuma domestica + Nigella sativa), T4= Polyherbal pellets (Curcuma mangga + Curcuma domestica + Nigella sativa), and T5= Uninfected control + Non-polyherbal pellets.
body temperature in average value. The normal temperature of goats is between 38.0°C and 39.9°C [30]. Our experiment showed that goats could stabilize the homeostatic situation [31].

Results also show that pulse rate affected highly significantly (p<0.010), and the pulse rate of all infected goats is lower than normal goats (T5). Popoola et al. [27] said that there is an association between pulse rate and metabolic rate, the reduction of metabolic rate could be due to decreasing pulse rate.

![Figure 3](image)

**Figure 3.** Correlation between respiration rate and HTC, with $R^2=0.9987$

Adianto et al. (2017) [32] reported no effect of the addition of different proteins on rectal temperature and respiratory rate. However, the addition of protein significantly increases the frequency of the heart rate.

### 4. Conclusion

Physiological responses of naturally infected goats supplemented with polyherbal and *Melastoma malabathricum* extract was still in normal standard value of Respiration rate, Rectal temperature, and Pulse rate. Goats could adapt in humid conditions (high THI) as indicated by the amount of Heat Tolerance Coefficient (HTC).

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