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The Effect of *Tinospora crispa* (L) on Performance, Rectal Temperature, Pulse and Respiratory Frequency of Local Sheep Kept in Different Type of House

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Abstract
A study was conducted to determine the effects of *Tinospora crispa* and type of house on body weight gain, dry matter intake, rectal temperature, pulse and respiratory frequency of local (fat tail) sheep. The study was done at the Faculty of Animal Husbandry and Fisheries, University of Tadulako, Indonesia for 56 days. A total of 18 local sheep (fat tail) wer used in this study. The sheep were alocated into 18 individual pen. The sheep were acclimatized to house condition for the first two weeks, from days 1 to 14, and data collection was from days 15 to 56. The sheep were fed 1% concentrate and 2% maize forage of live body weight. A total of 2% maize forage of live body weight was offered after consuming the concentrate. The amount of feed offered to the sheeps was adjusted weekly according to live body weight. The sheeps were fed at 08.00 hour, and water was available at all times. Different concentration of water-extracted *Tinospora crispa* (1%, 2% and 3%) was given to the sheep by mixing it with dringking water. Body weight gain, feed intake, feed conversion rasio, rectal temperature, pulse and respiratory frequency were measured as parameters. A split plot design was adopted in this experiment with 2 different type of house (close and open houses) as a main plot, 3 treatment diets (levels of *Tinospora crispa*) as a sub-plot and three replications. Data were analysed by analysis of variance using the Minitab. Results of analysis of variance showed that the using open house increased body weight gain and feed efficiency. Diets containing 3% *Tinospora crispa* in drinking water produced higher body weight gain, feed intake and feed conversion efficiency. Interaction between type of house and levels of *Tinospora crispa* was found in body weight gain and feed conversion efficiency. Open house could improve body weight gain and feed conversion efficiency when the drinking water contained 1 and 3% water - extracted *Tinospora crispa*, while sheeps fed 2% water – extracted *Tinospora crispa* in open house had the same body weight gain and feed conversion efficiency as sheep kept in the close house. In conclusion, Type of house affect and levels of *Tinospora crispa* affected body weight gain and feed conversion efficiency and interaction between type of house and levels of *Tinospora crispa* was found in body weight gain and feed conversion efficiency.
Keywords: Tinospora crispa, Type of house, performace, sheep

1. Introduction

Since climate directly influences the physiological condition of the animal, controlling micro-climate in the house is one of the main concerns to minimize the negative impact of hot temperature and high humidity (Anderson , 1983), particularly in the tropical region. Although, sheep has been reported to easily adapt to the wide range of temperature (Edey, 1983). High temperature may deteriorate the production of the sheep. According to Sutherland (1973), when the temperature rises above the critical point at 39° C, the heat load of the body begins to rise. The heat will be released into the environment in the form of water as a product of evaporation through the mouth, and lungs.

According to Curtis and Stanley (1981) thresholds temperature for sheep skin to sweat are at an ambient temperature of 32° C. While the rectal temperature of 39.5 ° C, sheep tended to breath faster to reach 300 beats per minute, being above the normal breath of 20-50 times per minute. Once the rectal temperature reached 41° C, sheep suffers from panting (Hafez , 1968). Church (1988) stated that heat load and other stresses can affect feed intake, in whcih mild heat stress with an ambient temperature of 25° C - 35° C could decrease feed intake by 3-10 %.

House plays a role in reducing heat stress in livestock. Devendra (1994) stated that in the presence of temperature and heavy rainfall in the tropics, a good house with good ventilation and roofs can effectively provide prevention against solar radiation. Another environmental factor affecting productivity of sheep is thhe diet consumed. When sheep are fed only forage, nutrient requirements for growth are not sufficient. Therefore it is necessary to find alternative feedstuffs that are cheap and readily available to minimize production cost and to achieve optimum production.

T*inospora crispa* (L) (family of Menispermaceae) is popularly known in Indonesia as “Bratawali”. This plant has been traditionally used as herbal remedy with several benefits, such as: improve respiratory organ function and increase appetite (Sulaiman *et al*., 2008 and Rudeewan *et al*., 2010). These functions may be associated with many types of chemical compounds found in this plant, such as: flavonoid , alkaloids, tannins and saponins

(Sulaiman *et al*., 2008 and Rudeewan *et al*., 2010). The property of increasing appetite present in *Trinospora crispa* could improve feed intake and body weight gain. A study was carried out to determine the effect of feeding *Tinospora crispa* on performance, rectal temperature, pulse and respiratory frequency of sheep kept under different type of house.

2. Materials and Methods

2.1. Water extract of Trinospora crispa

The leaves and stems of *Trinospora crispa* were collected locally and sun dried for 3 days. These parts of plant were analyzed for dry matter (DM), crude protein, crude fibre, lipid and ash contents (AOAC, 1990). The proximate fractions of dried Trinospora crispa were 89% dry matter, 11.40% protein, 34.58% crude fibre, 2.21% lipid and 6.40% ash. The dried *Trinospora crispa* was finely ground to 1-2 mm particle size and boiled with different quantity of distilled water (10, 20 and 30 g dried *Trinospora crispa* in 1 l water) at 100^{o}C for 30 minutes. The supernatant was filtered with muslin cloth. The liquid was stored and used as a part of drinking water.

2.2. Location and animals used in study

The study was carried out in the Animal House at The Faculty of Animal Husbandry, University of Tadulako, Palu, Indonesia. A total of 18 male local sheep (8 to 10 months old with initial body weight of 10 to 16 kg) were used in this study and kept for six weeks. The sheeps were alocated into 18 individual pens. Each pen was equipped with a drinker and feeder. The sheep were acclimatized to house condition for the first two weeks, from days 1 to 14. After two weeks adaptation period, on day 15, the sheep were individually weighed and the data collection started from days 15 to 56. The pens and surroundings were cleaned daily.

2.3. Feed and feeding

Diets were formulated by using several ingredients (see Table 1) to meet the nutrient requirements of sheep. The basal diet imposed is described in Table 2. The treatments consisted of two types of house and three different levels of *Trinospora crispa*. Detail of the treatments is presented in Table 3.

Table 1. Nutrient content of the ingredietns used in this study

Ingredients	DM (%)	Protein (%)	Lipid (%)	Crude fibre (%)	Total digestible nutrients (%)
Maize forage	22.0	2.3	0.25	7.1	45.0
Maize	86.0	10.3	1.51	2.5	86.0
Rice bran	86.0	7.6	11.98	27.8	51.0
Copra meal	86.0	21.6	13.10	12.1	85.0
Full fat soybean meal	86.0	34.0	15.43	6.0	70.0

Table 2. Ingredient and nutrient composition of basal diet diet (%)

Dietary components	**Concentration**
Maize	25.0
Rice bran	50.0
Copra meal	11.0
Full fat soybean meal	14.0
Calculated composition; Dry matter (%)	86.0
Crude Protein	13.2
Total Digestible Nutrients	66.6

Table 3. Details of experimental treatments

Type of House	**Crispa Trinospora levels**	**Details**
Open House	1%	OH1
	2%	OH2
	3%	OH3
Close House	1%	OH1
	2%	OH2
	3%	OH3

The sheep were fed 1% concentrate and 2% maize forage of live body weight. A total of 2% maize forage of live body weight was offered after consuming the concentrate. The amount of feed offered to the sheep was adjusted weekly according to live body weight. The sheep were fed at 08.00 hour in the morning and 16.00 in the afternoon, and water was available at all times.

2.4. Parameters measurements

Body weight gain of the sheep and dry matter intake were measured weekly and expressed as g dry matter/head/day. Rectal temperature was recorded individually at 12.00 h. Electronic thermometer was inserted at depth of about 6 cm. Stethoscope was used to record puls and respiratory frequency.

2.5. Statistical analysis

A split plot design was adopted in this experiment with 2 different type of house (open and close house) as a main plot, 3 treatment diets (0, 1 and 2% *Trinospora crispa*) as a sub-plot and three replications. Data were analysed by analysis of variance using the Minitab 14 statistical program (Minitab, 2003). The significance of difference between pairs of treatment means within any overall treatment effects, found significant by analysis of variance, was tested by Tukey Test (Steel and Torrie, 1980).

3. Results and Discussions

Data of body weight gain, dry matter intake, feed conversion efficiency (FCE), rectal temperature, pulse and respiratory frequency are shown in Tables 4, 5, 6 and 7. The effect of type of house on body weight gain and feed conversion efficiency was significantly difference, but not on dry matter intake, rectal temperature, pulse and respiration frequency. Addition of water -extracted *Trinospora crispa* produced a significant effect on body weight gain, voluntary intake of dry matter and feed conversion efficiency. There was an interaction between type of house and addition of *Trinospora crispa* found in body weight gain and feed conversion efficiency.

Table 4. Effect of type of house on performance, rectal temperature, pulse and respiratory frequencey of sheep

Parameters	**Type of house**		**Difference of significance**
	Close	**Open**	
Body weight gain	89.15 ± 4.29^{b}	94.71 ± 5.06^{a}	**
Volunary intake od dry matter	471.00±25.3a	479.00 ± 21.2^{a}	ns
Feed conversion efficiency	0.19 ± 0.001^{b}	0.20 ± 0.001^{a}	**
Rectal Temperature	38.59 ± 0.12^{a}	37.47 ± 0.39^{a}	ns
Pulse frequency	90.42 ± 0.44^{a}	80.23 ± 0.45^{a}	ns
Respiratory frquency	27.77 ± 0.78^{a}	24.02 ± 0.62^{a}	ns

Values with the same superscript within a row are not significantly different (P<0.05)
**: very significant, ns: non-significant

Table 5. Effect of type of *Trinospora crispa* on performance, rectal temperature, pulse and respiratory frequencey of sheep

Parameters	**Experimental diets**			**Difference of significance**
	R0	**R1**	**R2**	
Body weight gain	78.17 ± 2.78^{b}	90.08 ± 2.25^{b}	107.54 ± 2.32^{a}	**
Feed intake	456.33 ± 30.7^{b}	475.00 ± 28.3^{ab}	493.67 ± 27.4^{a}	**
Feed conversion efficiency	0.18 ± 0.001^{c}	0.19 ± 0.001^{b}	0.22 ± 0.001^{a}	**
Rectal temperature	38.44 ± 0.07^{a}	37.95 ± 0.12^{a}	37.70 ± 0.13^{a}	ns
Pulse frequency	86.49 ± 0.37^{a}	85.40 ± 0.69^{a}	84.10 ± 0.55^{a}	ns
Respiration Frequency	26.72 ± 1.18^{a}	25.75 ± 0.39^{a}	25.21 ± 0.91^{a}	ns

Values with the same superscript within a row are not significantly different (P<0.01)

Table 6. Effect of type of house and *Trinospora crispa* on body weight gain (g/head/d) of sheep

Type of House	Diet treatments			Difference of significance
	R0	R1	R	
Close house	$76.19\pm^{r}_{b}$	$88.89\pm^{q}_{a}$	$102.38\pm^{p}_{b}$	**
Open house	$80.16\pm^{r}_{a}$	$91.27\pm^{q}_{a}$	112.70^{p}_{a}	**
Difference of significance	**	**	**	

Values with the same superscript (ab) within a column are not significantly different (P<0.01)
Values with the same superscript (pq) within a row not significantly different (P<0.01)

Table 7. Effect of interaction between type of house and *Trinospora crispa* on feed conversion efficiency.

Type of House	Diet Treatments			Difference of significance
	R0	R1	R2	
Close house	$0.17\pm^{r}_{b}$	$0.19\pm^{q}_{a}$	$0.21\pm^{p}_{b}$	**
Open house	$0.18\pm^{r}_{a}$	$0.19\pm^{q}_{a}$	$0.23\pm^{p}_{a}$	**
Difference of significance	**	**	**	

Values with the same superscript (ab) within a column are not significantly different (P<0.01)
Values with the same superscript (pqr) within a row are not significantly different (P<0.01)

The average body weight gain of sheep was 89.15 g/head /day for the sheep kept in the close house and, 94.71 g/head/day for open house. Higher body weight gain of sheep in open house than those of sheep kept in close house was found in this current study. This might be due to the fact that the temperature in the open house was cooler than those in close house. Our unpublished data indicated that the average temperature in open house was about 27^{o}C, while in close house was 32^{o}C. The temperature in close house might be outside the thermonetral zone of the sheep. Hence, more energy is needed to regulate the body temperature, leaving less energy can be used for growth (Yousef, 1985).

According to Hafez (1968), temperature could affect feed intake, in which each increase in 1^{o}C in temperature could decrease feed intake by 1.7%. Moreover, if the temperature continues to rise, central nervous system would get impacted, resulting in decreased dry matter intake and increased water consumption. Although the sheep in close house tended to consume less than those of sheep in open house, the data of this current study did not show any significant different in feed intake.

Rectal temperature, pulse and respiratory frequency are commonly used for physiological indicator for studying environmental adaptation of the animal. Although the average of rectal temperature, pulse and respiration frequency were relatively the same, it is interesting to note that lower rectal temperature led to lower pulse and respiration frequency (Sleiman and Abisaab, 1995). At first, increasing environmental temperature led to increasing respiration rate. The temperature at which faster respiration rate or panting is initiated, heat loss mechanisms will rely on humidity, ventilation and airflow to the animal.

The effect of *Tinospora crispa* on body weight gain of sheep has scarcely been reported. A study conducted by (Buakeeree and Thepparat, 2006) indicated that the addition of *Tinospora crispa* in pig diets did not produced a significant increase in body weight gain and feed efficiency. This current study indicated that the average body weight gain of sheep fed R0 was 78.17 g/head/day, 90.08 g/head/day for R1 and 107.54 g/head/day for R2. The addition of 2% water - extracted *Tinospora crispa* in drinking water improved body weight gain. It is hard to elaborate this finding since there are a lot of bioactive compounds present in this plant that may play a role for this improvement. Since dry matter intake of the sheep consuming 2% water – extracted *Tinospora crispa* increased, it can be said here that the increased body weight gain might be associated with the increased feed intake ($Y = 0.786 x – 281.6$; $R^2 = 0.988$). An 8% increased dry matter intake due to addition of 2% *Trinospora crispa* justified the traditional use of this plant as appetite enhancer. The reason behind the increase in dry matter intake is still unclear. Feed conversion efficiency was also increased due to addition of *Tinospora crispa*. It is not hard to elaborate the improvement of feed conversion efficiency in this present study since body weight gain also increased due to supplementation of *Trinospora crispa*.

Although dry matter feed intake could affect rectal temperature, pulse and respiratory frequency, this present study indicated differently, in which rectal temperature, pulse and respiratory frequency were not affected by water – extracted *Trinospora crispa* supplementation. There was interaction between type of house and level of water – extracted *Trinospora crispa* found in dry matter intake and feed conversion efficiency. The sheep kept in open house produced better dry matter intake and feed conversion efficiency than those of sheep kept in close house when the sheep were fed 0 and 2% water – extracted *Trinospora crispa*, but not in 1% *Trinospora crispa*. It is hard to elaborate this phenomenon. It can be speculated here that the addition of 1% water – extracted *Trinospora crispa* is too low to have a positif impact on sheep performance. Further study is needed to clarify this speculation.

In conclusions, sheep kept in open house were bigger and more efficient than those of in lose house and increasing levels of water – extracted Trinospora crispa improved body weight gain, feed intake and feed conversion efficiency. Interaction between type of house and levels of *Trinospora crispa* was found in dry matter intake and feed conversion efficiency.

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