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# Effect of *Gynura Procumbens* (Sambung Nyawa) on Sheep Performance, Health Status, and Methane Emission

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## ABSTRACT

*Gynura procumbens* (Sambung nyawa) has been widely used as a herbal medicine since it is rich in bioactive compounds. Moreover, *Gynura procumbens* also has become a potential plant that control parasitic nematode infection. The research aimed to investigate the effect of *G. procumbens* on sheep performance, health status, and methane production. A total of twelve six-month-old lambs (ABW 11.27 ± 2.19 kg) were categorized based on live weight and fed one of feed treatments: wild grasses (40%) and concentrate (60%) (control/P0), P0 + 5% *G. procumbens* (P1), and P0 + 10% *G. procumbens* (P2). Feed intake, parasitic infection, and physiological status were measured weekly. *G. procumbens* at 5% level showed normal respiration rate, but the respiration and heart rates of lambs were abnormal. The 10% *G. procumbens* increased daily weight gain. *G. procumbens* addition up to 10% reduced the number of *Strongyloides* on feces and enteric methane emissions compare to control. It concluded that 5% *G. procumbens* can be used as an *anthelmintic* forage by improving health status, performance, and reducing methane emissions of sheep.

**Key words**: *Gynura procumbens*, herb medicine, nematodes infection, parasite population, sheep performance

## ABSTRAK

*Gynura procumbens* telah umum digunakan sebagai obat herbal karena kaya akan senyawa bioaktif. Lebih lanjut, *Gynura procumbens* berpotensi sebagai tumbuhan yang dapat mengontrol infeksi cacing pada ternak. Penelitian ini bertujuan untuk mengkaji pengaruh penambahan *G. procumbens* pada ransum terhadap pertumbuhan, status Kesehatan, dan produksi metan. Penelitian ini menggunakan dua belas ekor domba berumur < 1 tahun (BB 11,27 ± 2,19 kg). Ternak dikelompokkan berdasarkan berat hidup dan diberikan salah satu dari perlakuan pakan: rumput lapang (40%) dan konsentrat (60%) (kontrol/P0), P0 + 5% *G. procumbens* (P1), dan P0 + 10% *G. procumbens* (P2). Peubah yang diukur adalah konsumsi harian, performa, status fisiologis ternak dan infeksi cacing dilakukan setiap minggu. Hasil penelitian menunjukkan bahwa respirasi ternak domba pada 5% *G. procumbens* berada dalam kisaran normal, namun terjadi abnormalitas pada suhu dan denyut nadi. Penambahan *G. procumbens* dalam pakan 10% dapat meningkatkan pertambahan bobot badan harian. Penambahan *G. procumbens* sampai 10% dapat menurunkan jumlah telur cacing *Strongyloid* dalam feses dan emisi gas metana yang dihasilkan ternak domba. Dari penelitian ini dapat disimpulkan bahwa *G. procumbens* dapat digunakan sebagai hijauan tambahan sebanyak 5% untuk meningkatkan performa ternak, *anthelmintic*, dan mengurangi emisi gas metana.

**Kata kunci**: *Gynura procumbens*, infeksi cacing, obat herbal, performa domba, populasi parasit

## INTRODUCTION

Parasitic nematodes in the gastrointestinal tract of sheep have a significant impact on animal health and welfare, due to the pathological consequences and production losses in both animal performance and reproduction. Nutrient uptake is reduced (Yoshihara *et al*. 2023), weight gain is decreased by 77% (Mavrot *et al*. 2015), and reproductive performance is lowered (Hernández-Russo *et al*. 2021). Gastrointestinal nematode infection control is crucial for increasing sheep productivity and welfare. This can be achieved through various methods, such as antibiotics, *anthelmintic* products, feeding, grazing, and cage management. However, the use of antibiotics and *anthelmintic* products can result in significant costs, production losses, and the development of *anthelmintic* resistance (Vineer *et al.* 2020).

In light of the growing body of information regarding bioactive plants rich in secondary metabolites, the possible use of feeding and grazing management is becoming increasingly popular as a valuable solution to modulate the biology of parasitic nematodes (Hoste *et al.* 2011). Furthermore, high-quality forage has been shown to enhance animal immunity, while the use of plant bioactive compounds can provide an efficient method of control (Mitiku 2018). It is important to note that using forage as an *anthelmintic* control method should be easily accessible and simple for farmers to grow.

*Gynura procumbens* or sambung nyawa is an endemic plant in Indonesia that is known for its rich bioactive compounds and its use as a herbal medicine (Tan *et al*. 2016). *G. procumbens* contains many compounds such as steroids, flavonoids, saponins, tannins, terpenoids (Quyen *et al*. 2019), phenolics, fatty acids, oxo monocarboxylic acids, porphyrins, and chlorophyll fragments (Septaningsih *et al*. 2022). In recent research, bioactive compounds such as polyphenols, tannin, and flavonoids have an *anthelmintic* activity that was effective in larvae exsheathment and egg hatching, particularly proanthocyanidins and luteolin (Oliveira *et al*. 2021). In addition, tannins, saponins, halogenated compounds, and essential oils effectively in decreases methane or methanogens up to 42% (Martin *et al.* 2021).

This plant is considered to be a valuable forage for ruminants because it has no anti-nutritional factors (Idris & Markom 2019) and can be found naturally in Indonesian households as a garden plant or natural fence. The *G. procumbens* bioactive compounds are related to some health benefits of animal livestock, especially as *anthelmintic*s and methane reductors. Therefore, the research hypothesis was *G. procumbens* has positive effect on sheep health. The purpose of this research is to investigate the utilization of *G. procumbens* as an *anthelmintic* forage for sheep and its effect on sheep performance, parasite population, and in vitro methane production.

## METHODS

The research was conducted on sheep farm at the Laboratory of Cattle Nutrition, Department of Nutrition and Feed Technology, Faculty of Animal Science, IPB University, Bogor Indonesia. The farm was located at 6°33'10.624" S latitude and 106°43'21.719" E longitude at an altitude of 202 meters above sea level.

In a controlled study, twelve lambs naturally infected with *Strongyloideses* sp, with an average live-weight of 11.27 ± 2.19 kg, were categorized into light (7-9 kg), mid (10-12 kg), and heavy (11-14 kg) groups based on their live-weight. The lambs were then randomly fed a formulated ration as shown in Table 1. The sheep were kept in individual pens and were fed twice daily with ad libitum access to water. Prior to the treatments, the lambs has a feeding adaptation period that lasted for one week. The feeding parameters, including daily consumption, dry matter intake (DMI), feed efficiency (FE=DMI/ADG, as per Lima *et al*. 2017), and animal psychological status, were evaluated once a week by measuring respiration, heart rate, and body temperature. Animal performance was evaluated three times during the course of the research, at the beginning, middle, and end of the study. Parasitic infection was investigated by collecting feces from the pens, preserving them in a cooling box with 10% formalin solution, and then examining them in the laboratory (as per Raihan *et al*. 2022). Standard keys for identifying parasites *Strongyloides* and their developmental forms based on morphological and morphometric characteristics of eggs, larvae, and/or adult forms were used for the detection and determination of parasites and their developmental forms. The feed efficacy was the percentage of de-parasitism that was calculated by the formula as follows: ((N-n) x 100)/N; where N was average *Strongyloides* count in negative control animal, n was the average Strongyloides count in treated lambs (Ahmed *et al.* 2007). In vitro methane gas production analysis was conducted using Theodorou's method (1994) to measure the total gas produced during in vitro rumen fermentation. The total gas production was recorded and collected after the incubation process, and it was later measured using a gas chromatography analyzer to obtain data on methane emissions production (Jayanegara *et al*. 2015).

The data were analyzed using ANOVA (analysis of variance) through R i386 3.6.1 with packages Rcmdr, agricolae, car, and emmeans. The significantly different data among treatment groups were determined using the Tukey test at $p<0.05$.

## RESULTS AND DISCUSSION

**Lambs' physiological Status**

The research found that the respiration rate of the lambs was within the normal range of physiological status, as presented in Table 2. However, an abnormal condition

was observed in some of the lambs, specifically a low pulse rate and temperature, including in the control treatment, which deviated from normal values (Jackson & Cockcroft 2002). The abnormal respiratory pattern was attributed to the bioclimatic conditions of the indoor system under the tropical rain forest, caused by high humidity levels, which led to an increase in pulse rate to maintain optimal physiological conditions (Suprayogi *et al*. 2006). Thus, the lambs showed a low pulse rate on all treatments, but there was a lower pulse rate on the 5% *G. procumbens* treatment which could indicate a stress-reducing effect of a regular pulse rate (Kovács *et al*. 2014). A similar pattern of lambs' physiological status on control and P2 treatment related to feed quality on both treatments (Table 1).

**Table 1** Feed ingredients and chemical composition of ration (% DM)

| Component | P0 | P1 | P2 |
|---|---|---|---|
| Complete feed | | | |
| Grasses hay | 40 | 40 | 40 |
| *G. procumbens* meal | 0 | 5 | 10 |
| Palm kernel meal | 19.2 | 15.2 | 11.2 |
| Soybean meal | 16 | 15 | 14 |
| Cassava bagasse | 9 | 9 | 9 |
| Pollard | 8 | 8 | 8 |
| Mollases | 7 | 7 | 7 |
| Salt | 0.3 | 0.3 | 0.3 |
| $CaCO_3$ | 0.5 | 0.5 | 0.5 |
| Chemical composition (%) | | | |
| Dry matter | 86.59 | 85.77 | 86.02 |
| Ash | 6.48 | 7.58 | 7.56 |
| Crude protein | 21.11 | 21.50 | 19.87 |
| Ether extract | 3.75 | 3.44 | 2.93 |
| Crude fiber | 13.37 | 10.60 | 10.51 |

P0: complete feed; P1: complete feed with 5% *G. procumbens*; P2: complete feed with 10% *G. procumbens*

**Lambs' consumption, Weight Gain, and Feed Efficiency**

The research conducted over a 5-week testing period demonstrated that the daily feed consumption of lambs ranged from 1083.03 to 1104.99 g $day^{-1}$ (Table 3). All of *G. procumbens* was consumed due to its blended with the concentrate and given before forage. As a result of this feed consumption, the lambs achieved an average daily weight gain of 90.99 to 108.11 g/day. The addition of *G. procumbens* at a rate of 5% reduced the daily weight gain, but increasing the percentage to 10% increased daily weight gain. The dynamics of daily weight gain were reflected in the feed efficiency, which showed that the addition of *G. procumbens* at 5% reduced the efficiency of feed, but it increased at 10%. The decrease in feed efficiency was related to the lower daily weight gain, which was affected by abnormal values of respiration and heart rate. Astuti & Sudarman (2015) reported that an increase in respiration was correlated with environmental temperature, which reduced feed ingestion and slowed the lambs' metabolism.

It has been observed that the inclusion of *G. procumbens* in feed compositions tends to enhance feed efficiency in lambs. The feed compositions had similar energy levels, with a decrease in protein content in the second treatment due to changes in feed ingredients, such as the replacement of palm kernel meal and soybean meal with *G. procumbens*. This finding is consistent with the results reported by da Silva *et al*. (2019), which suggest that feed supplementation may not increase chemical composition (crude protein) but can have significant implications on animal health and reproductive systems. Additionally, the feed supplement may also affect lambs' intake due to changes in feed palatability or animal preference (Ali *et al*. 2012). Increasing feed intake improves the lambs' daily weight gain (Badarina *et al.* 2015).

**Parasitic Infection on Lambs**

The results of the fecal plates revealed that all lambs were infected with the *Strongyloides* parasite within a range of 383.33 to 2850 before treatment (Figure 1). After five weeks of feeding and management, the control feed without *G. procumbens* (P0) resulted in an increase in the number of *Strongyloides* on feces, from 750 to 900. Research conducted by Romero *et al.* (2022) investigated the highly pathogenic *Strongyloides* sp. parasitic infection in the small intestinal, duodenum, and jejunum of lambs, which increases the probability of parasitic infection surviving. Conversely, the addition of *G. procumbens* to

**Table 2** Lambs' respiration, heart rate and body temperature during research

| Parameter | Treatments | | | SEM | p<0.05 | Normal values[1] |
|---|---|---|---|---|---|---|
| | P0 | P1 | P2 | | | |
| Respiration (inspiration/min) | 41 | 41 | 42 | 5.27 | | 36 – 48 |
| Pulse rate (beat/min) | 71 | 65 | 72 | 2.48 | * | 80 – 100 |
| Body temperature (°C) | 38.71 | 39.12 | 39.40 | 0.18 | | 39.00 – 40.00 |

[1]Jackson and Cockcroft (2002); P0: complete feed; P1: complete feed with 5% *G.procumbens*; P2: complete feed with 10% *G.procumbens*

**Table 3** Lambs' feed consumption, daily weight gain, and feed efficiency during the research

| Variable | Treatments | | | SEM | p <0.05 |
|---|---|---|---|---|---|
| | P0 | P1 | P2 | | |
| Feed consumption (g head$^{-1}$ day$^{-1}$) | 1104.99 | 1089.33 | 1083.03 | 274.32 | |
| Total dry matter intake (g head$^{-1}$ day$^{-1}$) | 406.13 | 401.13 | 400.72 | 111.06 | |
| Average daily weight gain (g head$^{-1}$day$^{-1}$) | 104.50 | 90.99 | 108.11 | 6.04 | * |
| Feed efficiency (%) | 3.89 | 4.41 | 3.71 | 0.12 | . |

P0: complete feed; P1: complete feed with 5% *G. procumbens*; P2: complete feed with 10% *G. procumbens*

the feed was found to effectively reduce the number of *Strongyloides* by 5% (116.67) and 10% (250).

The efficacy calculation revealed that *G. procumbens* could control the *Strongyloides* until 72.22% (10%) to 87.04% (5%) (Table 4). The efficacy values show differences in the suppression of *Strongyloides* due to parasite infection control, which is also affected by feed nutrient content (Ahmed *et al*. 2007). Nutrient intake improvement would increase the immune system that suppresses parasite existence (Badarina *et al*. 2015).

### Methane

The methane emissions in vitro test on all *G. procumbens* treatments were significantly lower than the control group ($p<0.05$). This reduction in methane emissions may be attributed to the bioactive compounds present in *G. procumbens*. Tava *et al*. (2022) reported that several bioactive compound, especially tannins could affect the fermentation rate of feed.

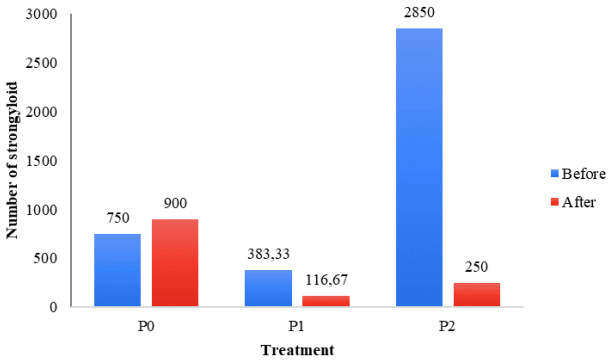


**Figure 1** Number of *Strongyloideses* sp on lambs' feces. P0: complete feed; P1: complete feed with 5% *G.procumbens*; P2: complete feed with 10% *G.procumbens*

## CONCLUSION

*G. procumbens* 5% can be used as an *anthelmintic* forage to control parasitic nematodes in sheep, improve health performance, and reduce methane emissions for sheep.

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