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Feed Fermentability and Physiological Index of Sheep Supplemented with Garlic and Seaweed Powder in Organic Chromium Basal Feed

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ABSTRACT

This study aimed to identify the effect of supplementing garlic and seaweed powder into basal feed with organic chromium on the consumption and digestibility of dry matter (DM), organic matter (OM), crude fiber (CF), and crude protein (CP), ruminal fluid pH, and blood glucose level of the sheep. Three treatments with 5 replicates were subjected to experimental feed, consisting of R0 as basal feed (70% forage and 30% concentrate), R1 (basal feed + 250 ppm garlic powder), and R2 (basal feed + 3.6% seaweed powder). The result showed that the treatments did not significantly affect ($P>0.05$) the intakes of DM, OM, CF, and CP, digestibility of OM, and ruminal fluid pH. Significant effects ($P<0.05$) were observed on the digestibility of DM, CF, and CP, as well as blood glucose. Garlic powder supplementation for sheep feed produced better fermentability and physiological indexes compared to control.

Keywords: Fermentability, Physiological indexes, Garlic, Seaweed, Chromium Mineral.

1. INTRODUCTION

Feed consumed by cattle will be fermented in the rumen. During ruminal fermentation, part of the consumed energy and protein will not be used by the ruminal microflora or the host but released as nitrogen ammonia and methane instead [2]. Accordingly, nutritionists suggest optimizing the feed formulation and incorporating supplements into the feed. Previous studies reported that supplementing garlic powder (*Allium sativum*) and organic chromium into feed has increased consumption and digestibility of crude fiber and crude protein [4], while another study focuses on incorporating seaweed powder (*Gracilaria sp.*) into sheep feed and its effect on dry matter (DM) and organic matter (OM) digestibility and ruminal microflora [8]. This study aimed to evaluate the effect of supplementing garlic powder (*Allium sativum*) and seaweed (*Gracilaria sp.*) into sheep feed with organic

chromium on the consumption and digestibility of DM, OM, crude fiber (CF), and crude protein (CP), ruminal pH, and blood glucose.

2. MATERIALS AND METHOD

The study used 21 thin-tailed male sheep aged 7-8 month, kept in an individual caged and fed with 4.5% body weight (BW) of DM. Diet consisted of 70% forage and 30% concentrate (88.9% DM, 7.36% ash, 11.10% CP, 13.98% CF, 1.44% CFat, and 56.25% NFE), 1.5 ppm of organic micro mineral Chromium (Cr), 3.6% seaweed powder (*Gracilaria sp.*), 250 ppm of garlic (*Allium sativum*) and drinking water. The cage equipment included a bucket, knife, bottles, jar, blender, and an analytic scale with 0.01kg and 0.0001g accuracy. The laboratory apparatus were Kjeldhal flask, Erlenmeyer flask, distillation kit, micro biuret, pipette, electric stove, porcelain cups, filter paper,

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oven, furnace, desiccator, Bunsen burner, pliers, Buchner glass funnel, and kit for blood glucose analysis (spectrophotometer, centrifugal, test tube) and ruminal pH (pH meter). This study used three treatments: R0 (Basal feed + 1.5 ppm of organic Cr), R1 (R0 feed + 250 ppm of garlic powder), and R2 (R0 feed + 3.6% seaweed powder). The feed was offered two times a day, in the morning and afternoon. The forage was given at 08.00 and 16.00 WIB (GMT+7), while the concentrate was offered once at 07.00 WIB. Data on consumption and digestibility were collected on the last seven days of the feeding trial, while blood glucose data were collected four hours after the morning feeding and at the end of the feeding trial. The study was conducted at Gunung Tugel Farm, Purwokerto, and data analysis was performed in the Laboratory of Feedstuff, Faculty of Animal Science, Jenderal Soedirman University, Purwokerto.

3. RESULT AND DISCUSSION

3.1. Feed Consumption

The result showed that supplementing 250 ppm garlic powder (*Allium sativum*) and 3.6% seaweed (*Gracilaria sp.*) into sheep fed with organic chromium did not significantly affect ($P>0.05$) the consumption of DM, OM, CP, and CF. The result showed that garlic powder and seaweed powder supplements did not affect feed palatability. The process of nutrient feed utilization is influenced by the amount of feed intake [1]. Additionally, feeding level affects feed nutrient consumption and increases the possibility of cattle consuming more feed.

3.2. Feed Digestibility

Supplementing 250 ppm garlic powder (*Allium sativum*) and 3.6% seaweed (*Gracilaria sp.*) into sheep feed with organic chromium could improve the digestibility of DM, CP, and CF but did not increase organic matter digestibility. Garlic can improve ruminant digestibility and feed efficiency [12]. The CF and CP

contents in feed would affect the digestibility level [10]. The DM digestibility affects protein digestibility in the rumen because the population and activities of ruminal microbe would decline given the imbalance energy source and nitrogen availability for microbial protein synthesis [7]. The contributing factors to feed nutrient digestibility are feed composition, feeding ration, treatment feed, enzyme supplementation in feed, and the amount of feed offered [6].

Table 2. Effect of garlic powder and seaweed powder supplementation into sheep feed with organic chromium on digestibility of dry matter (DMD), organic matter (OMD), crude fiber (CFD), and crude protein (CPD).

| Parameter | Treatments | | |
|-----------|-------------------------|-------------------------|-------------------------|
| | R0 | R1 | R2 |
| DMD (%) | 76.20±2.79 ^a | 81.59±2.97 ^b | 79.56±3.46 ^a |
| OMD (%) | 48.57±6.94 | 57.00±5.03 | 54.23±8.66 |
| CFD (%) | 69.54±3.61 ^a | 76.06±2.22 ^b | 71.09±3.73 ^a |
| CPD (%) | 78.09±2.65 ^a | 84.00±2.28 ^b | 81.94±3.82 ^a |

Note: R0 (Basal feed + 1.5 ppm Organic Cr), R1 (Feed R0 + 250 ppm garlic (*Allium sativum*)), R2 (Feed R0 + 3.6% seaweed (*Gracilaria sp.*)). Means with superscripts within row show significant difference ($P<0.05$). DMD: Dry Matter Digestibility, OMD: Organic Matter Digestibility, CFD: Crude Fiber Digestibility, CPD: Crude Protein Digestibility.

3.3. Ruminal Fluid pH

The analysis of variance showed that the treatments did not significantly affect the ruminal fluid pH ($P>0.05$). The supplementation of garlic powder and seaweed powder into the basal feed with organic chromium did not produce a significant pH value but instead maintain a stable ruminal pH which prevents abnormal ruminal metabolism, including acidosis, in the cattle.

Table 1. Effect of garlic powder and seaweed powder supplementation into sheep feed with organic chromium on the consumption of dry matter intake (DMI), organic matter intake (OMI), crude protein intake (CPI) and crude fiber intake (CFI).

| Parameter | Treatments | | |
|------------------|-------------|-------------|-------------|
| | R0 | R1 | R2 |
| DMI (g/head/day) | 725±123.6 | 725.8±100.4 | 809.6±90.3 |
| OMI (g/head/day) | 306.97±47.2 | 299.53±54.5 | 347.74±35.8 |
| CPI (g/head/day) | 96.16±15.9 | 94.33±11.2 | 101.54±15.3 |
| CFI (g/head/day) | 182.6±30.6 | 180.99±24.3 | 196.26±32.6 |

Note: R0 (Basal feed + 1.5 ppm organic Cr), R1 (Feed R0 + 250 ppm garlic (*Allium sativum*)), R2 (Feed R0 + 3.6% seaweed (*Gracilaria sp.*)). DMI: Dry Matter Intake, OMI: Organic Matter Intake, CPI: Crude Protein Intake, CFI: Crude Fiber Intake.

The changed level of ruminal fluid pH may be attributed to the type of feed [11] and data collection time. Previous study [9] explained that the time of sample collection could affect the pH value of ruminal fluid. There was a correlation between time and the production of rumen fermentation product (VFA); at 0 hours after feeding, the ruminal pH tended to be higher because no fermentation occurs on feed that just enters the rumen. A few hours after feeding, the ruminal pH would decrease with the fermentation process that produces VFA (acetic acid). The ruminal pH would increase again four hours after feeding as the fermentation process acids slow down. The dynamic of this fermentation process has encouraged the researcher to collect ruminal fluid four hours after the feeding to obtain more stable and accurate data of ruminal fluid.

Table 3. Effect of garlic powder and seaweed powder supplementation into sheep feed with organic chromium on ruminal fluid pH

| Parameter | R0 | R1 | R2 | p-Value |
|------------------|-----------|-----------|-----------|---------|
| Ruminal fluid pH | 6.37±0.11 | 6.37±0.24 | 6.33±0.26 | 0.904 |

Note: R0 (Basal feed + 1.5 ppm Organic Cr), R1 (Feed R0 + 250 ppm garlic (*Allium sativum*)), R2 (Feed R0 + 3.6% seaweed (*Gracilaria sp.*)).

3.4. Blood Glucose Level

Previous studies reported that supplementing 250 ppm garlic powder (*Allium sativum*) or 3.6% seaweed powder (*Gracilaria sp.*) into basal feed with organic chromium could reduce the blood glucose up to the normal level. The supplementation showed a high significance (P<0.01) on blood glucose. Allicin in garlic stimulates the beta-pancreatic cells to produce more insulin to allow blood glucose absorbed into body tissues [5]. The main factors to blood glucose are feed consumption and the physiological

status of the cattle. Stress may affect feed consumption by decreasing energy intake from the feed [3].

Table 4. Effect of garlic powder and seaweed powder supplementation into sheep feed with organic chromium on Blood glucose

| Parameter | R0 | R1 | R2 | p-Value |
|----------------------|-------------------------|-------------------------|--------------------------|---------|
| Blood glucose(mg/dL) | 52.24±7.58 ^a | 34.92±6.92 ^b | 47.25±9.85 ^{ab} | 0.003 |

Note: R0 (Basal feed + 1.5 ppm Organic Cr), R1 (Feed R0 + 250 ppm garlic (*Allium sativum*)), R2 (Feed R0 + 3.6% seaweed (*Gracilaria sp.*)). Means with superscripts within row show significant difference (P<0.05).

4. CONCLUSION

Supplementing garlic powder and seaweed powder into the feed for sheep produced better feed digestibility and blood glucose level.

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