Effect of Supplementation of Comin\(^+\) and Zn-Biocomplex on The Performances of Ettawa Crossbred Goats


Digestibility of ruminant feeds, which is greatly determined by ruminal fermentation which in turn is greatly affected by microecology of the rumen. Manipulation of micro-ecology such as supplementing with various yeasts or micro elements could improve digestibility of the feed. The effect of Comin\(^+\) (R\(_1\)), biokompleks-Zn (R\(_2\)) or combination of both (R\(_3\)) on performances of Ettawa Crossbred kids, fed concentrate containing Aspergillus oryzae (R\(_0\)) was studied. Twenty four Ettawa Crossbred kids (6-8 month of age; initial liveweights = 16.63±2.10 kg) were divided into 4 groups. Feeds given were King grass and concentrate. The observations were carried out for 16 weeks with 2 weeks adaptation period and the experiment was conducted in a completely randomized design with 4 treatments and 6 replications. The results showed that supplementations significantly (P < 0.05) increased total DM intakes from 685 g/d (R\(_0\)) became 748, 711 and 858 g/h; and 748 g/h for R\(_1\), R\(_2\) and R\(_3\). It was concluded that supplementation of Comin\(^+\) (R\(_1\)) gave the best growth performance of Ettawa Crossbred goats, where ADG and FCR improved by 45.20% and 34.40%.

**Key Words:** Supplementation, Comin\(^+\), Zn-biocomplex, Performances, Goats

**ABSTRACT**


Kecernaan pakan pada ternak ruminan ditentukan antara lain oleh besarnya tingkat fermentasi di rumen, yang mana sebaliknya dipengaruhi oleh mikro-ekologi rumen. Manipulasi mikro-ekologi rumen seperti suplementasi dengan aneka kapang dan mikro-elemen dapat meningkatkan kecerunan pakan. Pengaruh suplementasi Comin\(^+\) (R\(_1\)), biokompleks-Zn (R\(_2\)) atau kombinasi keduanya (R\(_3\)) terhadap kinerja anak Kambing Peranakan Ettawa (PE), diberi pakan konsentrat yang mengandung Aspergillus oryzae (R\(_0\)), dipelajari pada percobaan ini. Sebanyak 24 ekor kambing PE (umur 6-8 bulan, BH awal = 16.63 ± 2.10 kg) dibagi menjadi 4 gruop. Pakan dasar yang diberikan adalah rumput raja (Pennisetum purpureoides) secara ad libitum dan konsentrat. Pengamatan dilakukan selama 16 minggu dengan masa adaptasi 2 minggu dan percobaan dilakukan menggunakan Rancangan Acak Lengkap dengan 4 perlakuan dan 6 ulangan. Suplementasi meningkatkan konsumsi total BK pakan secara nyata (P < 0.05) dari 685 g/h (R\(_0\)) menjadi 748, 711 dan 858 g/h; dan konsumsi BK rumput dari 304 g/h (R\(_3\)) menjadi 373, 331 dan 479 g/h, masing-masing untuk R\(_1\), R\(_2\) dan R\(_3\). Kecernaan BK, SDN dan energi tercerna tidak dipengaruhi (P > 0.05) oleh suplementasi. Namun suplementasi mempengaruhi tingkat kecerunan SDA dan PK secara nyata (P < 0.05). Suplementasi juga meningkatkan PBHH dari 65.18 g/h (R\(_0\)) menjadi 94.64, 83.04 dan 90.77 g/h; serta memperbaiki nilai RKP dari 10.51 (R\(_0\)) menjadi 7.82, 8.36 dan 9.46 masing-masing untuk R\(_1\), R\(_2\) dan R\(_3\). Disimpulkan bahwa suplementasi Comin\(^+\) (R\(_1\)) menunjukkan kinerja pertumbuhan kambing PE yang terbaik, dimana PBHH dan nilai RKP meningkat sebesar 45.20% dan 34.40%.

**Kata Kunci:** Suplementasi, Comin\(^+\), Biokompleks-Zn, Kinerja, Kambing PE

**INTRODUCTION**

Digestibility of ruminant feed, which are generally rich in fibre (ADF, NDF etc), is greatly determined by fermentation in the rumen. This is in turn greatly affected by microecology of the rumen. Manipulation of microecology such as supplementing with various microbes such as yeast or micro elements could improve digestibility of the feed.
Supplementation with yeast such as Aspergillus oryzae culture improved growth rate and feed efficiency in sheep (LUBIS et al., 2002a, 2002b) and milk production (CHIOU et al., 2002). Aspergillus oryzae supplementation also improved the population of anaerobic and selulolitic bacteria (NEWBOLD et al., 1992) and increased the number of fibriolitic bacteria (CHEN et al., 2004). LUBIS et al. (2002c) reported that Aspergillus oryzae culture improved in vitro fiber digestibilities of King grass and also improved the production of volatile fatty acids. AMLAN (2012) reviewed the use of live yeast, especially Aspergillus oryzae, as feed additives in ruminant nutrition.

Mineral supplementation has been shown to improve digestibility of feedstuff, hence performance of the animals. WILSON and MATHIUS (2006) reported that addition of mineral mixture (named as Comin) and protected protein increased nitrogen digestibility, liveweight gain and improved feed conversion ration (FCR). Similar results was also reported by PUASTUTI et al. (2006) that Comin enriched with fish meal (named as Comin") gave better feed efficiency in young sheep compared to Comin enriched with soy bean meal.

Zinc is one of the important trace minerals, having a role in over than 300 enzyme processes, involved in carbohydrates metabolism, protein and nucleic acid synthesis (UNDERWOOD and SUTTLE, 1999) and are inherently linked to health (DARMOH, 2007; ARIFIN, 2008) and performance (SUPRIYATI, 2008; JIA et al., 2009). Zinc in the form of organic, such as Zn-biocomplex is more available compared to Zn in the form of inorganic (SPEARS, 1996; SPEARS, 2003; CAO et al., 2000). The supplementation of Zn-biocomplex to ration based on grass-concentrate as basal diet significantly improved liveweight gain and feed conversion ratio of young sheep (SUPRIYATI and HARYANTO, 2007; SUPRIYATI, 2008; KARDAYA et al., 2001). HARYANTO et al. (2005) also reported that the supplementation of Zn organic on ration based on fermented riceconcentrate as basal feed improved the ADG of young sheep. SPEARS and KEGLEY (2002) reported that addition of 25 mg Zn/ kg to basal diets as Zn-proteinate improved animal performances, carcass characteristics, and immune response in growing and finishing steers. The improved productivity was due to the increasing in rumen microbial activity, since the function of Zn element has to stimulate the growth of rumen microbes (HARYANTO et al., 2006).

Accordingly the present experiment studied, the supplementation effects of Comin' and Zn-biocomplex alone, and their combination in ration containing Aspergillus oryzae on the growth performances of Ettawa Crossbred goats was carried out.

MATERIAL AND METHODS

Climate

The study of liveweight change, feed intake and digestibility was conducted at the Indonesian Research Institute for Animal Production in Ciawi Bogor, located to 107° east longitude, in the 6° latitude south and at an altitude of more than 400 meters above sea level, with an average annual rainfall 400 mm. Temperatures in Ciawi are seasonally uniform with the mean maximum temperature ranging from 25 to 30°C in the afternoon and the mean minimum temperature ranging from 18 to 23°C at night. Ciawi has humid tropical climate.

Production of Aspergillus oryzae fermented culture, Comin' and Zn-biocomplex

Aspergillus oryzae fermented culture (AOFC) was prepared by solid state fermentation in cassava waste as described by SUPRIYATI and KOMPIANG (2002). The AOFC was mixed with concentrate at 3% inclusion. Comin' was produced by mixing of macro and micro essential minerals enriched with fish meal (PUASTUTI et al., 2006). The Comin' was mixed with concentrate at 10% inclusion. Zinc-biocomplex was prepared by semi solid fermentation of inorganic Zn salt in corn gluten meal using Saccharomyces cerevisiae as an innoculan (SUPRIYATI, 2008).

Animal treatments

Twenty four 6-8 months old Ettawa Crossbred goats, with an average liveweight of 16.63 ± 2.10 kg initially, were grouped by weight and randomly assigned to four treatments (n=6 goats per treatment). The basal diets consisted of concentrate enriched with 3% AOFC and King grass (Penicillum purpuroides). Treatments consisted of R₀ (control (no supplementation), supplementation with R₁ Comin' (10% in concentrate), R₂ Zn-biocomplex (25 mg Zn/ kg concentrate) and R₃ Comin' (10% in concentrate) + Zn-biocomplex (25 mg Zn/ kg concentrate). The chemical composition of the feeds used in this experiment is presented in Table 1. King grass was given ad libitum and the enriched concentrate was given 400 - 500 g/h/d. Water was available anytime through nipples.
Animal management

At the beginning of the experiment all animals were dewormed with anthelmintic drug, and sprayed against external parasites. The animals were weighed at the beginning of the experiment, and fortnightly along 16 weeks trial, in the morning before feeding. The adaptation period was carried out for two weeks before observation of trial. The animals were housed individual in slatted-floor pens equipped with wooden feed through.

The parameters observed were feed nutrient intakes (DM, CP, NDF, ADF and ME), liveweight gains, feed conversion rations (FCRs), and nutrient digestibility.

Digestibility trial

The goats were housed in metabolic cages, which was designed to be able to separate the faeces and urine excretion. The slatted floor covered with a very fine wire netting that allows only urine to pass through. During the last 7 days of the experiment, feed eaten and refusal were weighed and recorded daily. Total daily faecal output for each goat was weighed daily, approximately 25% of the sample was removed for dry matter determination and the rest was dried in a forced-draught oven at 60°C for 48 h. Dry faeces were bulked separately for each goat during each period, milled with a simple laboratory mill and stored in plastic bags until required for analysis. Feed offered and refusals were also analyzed for chemical composition. The digestibility of dry matter and nutrients in each treatment were calculated according to the different between dry nutrient intakes with dry nutrients output through faeces. The DM digestibility was calculated according to the following equation: DMD (%) = (DM feeds – DM faeces)/ DM feeds × 100%.

Experimental design

The experiment was conducted in a completely randomized design with four treatments and 6 replications to test the hypothesis that the responses of goats were different between treatment with and without supplementation of Comin® and Zn-biocomplex. Data on feed intake, liveweight change and nutrient digestibility were statistically evaluated according to standard analysis of variance (STEEL and TORRIE, 1980) and if significant differences were observed treatment means were compared using the Duncan's multiple range test.

Chemical analysis

Laboratory analysis of grass, concentrate and faeces were performed at the Analytical Services Laboratories IRIAP, which accredited by National Accreditation Community, National Board of Standardization.

Feeds (grass and concentrate) and feses were analysed for DM, CP, and GE (AOAC, 2000), NDF and ADF (AOAC, 1995). Dry matter (DM) was determined by drying at 105°C overnight, ash by placing samples in a muffle furnace at 550°C overnight and crude protein (CP) by the micro-Kjeldahl and auto analysis procedure, using autoanalyzer Brand Luebe, Germany. Gross energy (GE) values were determined by a bomb calorimeter (Adiabatic Oxygen Bomb, Parr Instrument Co. 6900) using thermochemical benzoic acid as a standard. The neutral detergent fibre (NDF) and acid detergent fibre (ADF) contents were analysed by the method of van Soest.

RESULTS AND DISCUSSION

Effect of comin® and Zn- biocomplex on nutrient intake

Table 2 summarized the effect of treatment on nutrient intake. Total dry matter intakes (685 ± 65, 748 ± 103, 711 ± 49 and 858 ± 128 g/d for R0, R1, R2 and R3, respectively) were close to those recommended (690 g/d) by KEARL (1982) for goats, indicating that the trial animal is in normal health condition. Supplementation significantly (P < 0.05) increased the total dry matter intake. Since the amount of concentrate given were similar for all treatments, the difference in total dry matter intake is totally reflecting grass intake (304 ± 59; 373 ± 94; 331 ± 45 and 479 ± 117 g/d for R0, R1, R2 and
multinutrient block supplementation increased total intake of dry matter (520 versus 279 g/day).

From these results can be concluded that the difference of CP, GE, NDF and ADF intakes are reflection of the difference in grass intake.

Effect of Comin+ and Zn-biocomplex on nutrient digestibility

The values of digestibility coefficients (%) of nutrients are presented in Tables 3. The treatments had no effect (P > 0.05) on dry matter (DM), NDF and energy (DE/GE) digestibilities. These results corroborate with the findings of Jia et al. (2009) who observed no differences on DM and NDF digestibilities between control and supplemented Zn in Cashmere goats.

Meanwhile, the treatments had significant effects (P < 0.05) on digestibilities of ADF and CP. Digestibility of ADF was affected by Comin+ (R1 vs R0), and Zn-biocomplex supplementation alone (R2 vs R0) or in combination with Zn-biocomplex (R3 vs R0). Similarly, supplementation of Zn to basal diets had effect on NDF digestibility in growing lambs (Kardaya et al., 2001) and goats (Jia et al., 2009). Digestibility of CP was significantly increased by supplementation, Comin+ alone, Zn-biocomplex or combination of both. Improvement of crude protein digestibility could be due to Zn supplementation, which has been reported to improve protein metabolism (Underwood and Suttle, 1999). It should be noted that Comin+ also contain Zn in the form of inorganic salt.

Table 2. Contribution of King grass on total nutrient intake on goats fed grass and concentrate with and without supplementation of Comin+ and Zn-biocomplex

<table>
<thead>
<tr>
<th>Parameter</th>
<th>R0</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
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<tbody>
<tr>
<td>Grass</td>
<td></td>
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<tr>
<td>DM (g/d)</td>
<td>304 ± 59a</td>
<td>373 ± 94b</td>
<td>331 ± 45c</td>
<td>479 ± 117a</td>
</tr>
<tr>
<td>Concentrate</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>DM (g/d)</td>
<td>381</td>
<td>373</td>
<td>378</td>
<td>379</td>
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<tr>
<td>Total Feed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DM (g/d)</td>
<td>685 ± 65d</td>
<td>748 ± 103b</td>
<td>711 ± 49c</td>
<td>858 ± 128a</td>
</tr>
<tr>
<td>CP (g/d)</td>
<td>97.85 ± 6.82d</td>
<td>109.00 ± 10.82b</td>
<td>102.69 ± 5.12c</td>
<td>120.55 ± 13.48a</td>
</tr>
<tr>
<td>ME (kcal/kg)</td>
<td>1865 ± 171d</td>
<td>2063 ± 272b</td>
<td>1954 ± 129c</td>
<td>2371 ± 339a</td>
</tr>
<tr>
<td>NDF (g/d)</td>
<td>327 ± 47d</td>
<td>375 ± 74b</td>
<td>349 ± 35c</td>
<td>451 ± 92a</td>
</tr>
<tr>
<td>ADF (g/d)</td>
<td>207 ± 32d</td>
<td>242 ± 51b</td>
<td>220 ± 24c</td>
<td>303 ± 63a</td>
</tr>
</tbody>
</table>
The effect of treatments on performance of experimental goats was summarized in Table 4. The initial liveweight of the goats were similar for all treatments, averaging 16.63 ± 2.10 kg. The average daily gain (ADG) was significantly (P < 0.05) affected by treatments. The ADG of control (R0: 65.18 ±11.99 g/d) was significantly lower than that of supplemented groups, 94.64 ± 10.89 g/d, 83.04 ± 12.96 g/d and 90.77 ± 14.44 g/d for R1, R2 and R3 treatments, respectively. It means that ADG of supplemented groups improved by 45.20, 39.26 and 42.23% for R1, R2 and R3, compared to control (R0). The ADG between the supplemented groups, R1 was similar to R3 and both were higher than R2. This difference could be due to the presence of fish meal in Comin® (in R1 and R3) but not in Zn-biocomplex. These findings were similar to those reported by PRASTUTI (2006) in sheep, where the ADG of sheep supplemented with Comin® were 138 g/d significantly (P < 0.05) higher than control (121 g/d). However, WILSON and MATHIUS (2006) reported no significant difference on growth between lamb fed supplemented with Comin® and control (112.21 g/d vs 98.35 g/d). These similar effects of Zn-biocomplex were observed by SUPRIYATI (2008) and KARDAYA et al. (2001) who used Zn-biocomplex/Zn proteinate supplementation in lambs given grass-concentrate, they gained more liveweight (>20-25%) than those in the control treatment. HARYANTO et al. (2005) also reported that the supplementation of Zn organic in the lambs consuming fermented rice straw-concentrate improved the ADG by >20%. SPEARS and KEGLEY (2002) reported that Zn from Zn proteinates supplementation increased ADG during growing phase of steers. According to MC DOWELL et al. (1985), that the requirement of Zn for sheep was around 20-33 mg/DM kg, in this study the addition 25 mg Zn/ kg DM gave better response than control.

The development of goats liveweight with supplemenations is presented in Graph 1. The regression equations for R0 = 0.491x + 17.13 (r² = 0.971), R1 = 0.696x + 15.87 (r² = 0.993), R2 = 0.607x +16.63 (r² = 0.996) and R3 = 0.669x + 15.41 (r² = 0.993). The regression equations showed that the fastest growth rate occured at diet R3, followed by R2, R1 and R0. The regression equations for all treatments were linear indicating that the measurements was in the period of accelerated growth phase.

At the end of feeding trial (16 weeks), the liveweight of supplemented groups were similar, 26.80; 26.27 and 26.53 kg for R1, R2 and R3 treatments, respectively and all were significantly (P < 0.05) heavier than control (R0 = 24.27 kg).

The feed efficiency (FCR = DMI/ADG) values were also significantly affected by supplemements. The FCR value of control (R0 = 10.51) were significantly higher than the one fed supplement 7.82, 8.36 and 9.46 for R1, R2 and R3, respectively. There was also significant (P < 0.05) differences between supplemements (Table 4). Feed efficiencies of supplemements (R1, R2 and R3) compared to control, improved by 34.40, 25.72 and 11.10% respectively. This observation, effect of Comin®, was similar to those reported by WILSON and MATHIUS (2006), where the FCR of lambs supplemented with Comin® were significantly better than control. Furthermore, this similar effect of Zn-biocomplex was observed at previous study by KARDAYA et al. (2001), who used Zn-proteinate supplementation in the diets of lambs consumed grass-concentrate, gave better FCR values than those in the control treatment. Similarly, supplementation of Zn as either ZnSO₄ or Zn-methionate in the basal diets, improved feed efficiency in Cashmere goats (JIA et al, 2009).
Table 4. Effect of Comin’ and Zn-biocomplex on performance of experimental goats

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R0</td>
</tr>
<tr>
<td>Initial liveweight, kg</td>
<td>16.97 ± 1.37</td>
</tr>
<tr>
<td>Final liveweight, kg</td>
<td>24.27 ± 2.24a</td>
</tr>
<tr>
<td>ADG, g/d</td>
<td>65.18 ± 11.99c</td>
</tr>
<tr>
<td>FCR (DMI/ADG)</td>
<td>10.51 ± 1.34d</td>
</tr>
</tbody>
</table>

abcd means in the same row with different superscripts are significantly different (P < 0.05)

Graph 1. The development of goats liveweight at different supplementations

**CONCLUSION**

Performance of goats fed concentrate based on Aspergillus oryzae fermented culture (AOFC) could be improved by mineral supplementation (Comin’ or Zn-biocomplex) as indicated by better growth rate and FCR, which in turn due to the improved feed digestibility (CP and ADF). Supplementation of Comin’ gave the best performance of goats, indicated by the improvement of ADG and FCR values by 45.20% and 34.40%.

**REFERENCES**


