Effect of Supplementations of Comin+ and Zn-Biocomplex on The Performances of Ettawa Crossbred Goats

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ABSTRAK

SUPRIYATI, W. PUASTUTI, I-G.M. BUDIARSANA dan I-K. SUTAMA . 2012. Pengaruh suplementasi comin+ dan Biokompleks-Zn terhadap kinerja kambing Peranakan Ettawah. *JITV* 17(4): 290-296.

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 kecernaan 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 grup. Pakan dasar yang diberikan adalah rumput raja (*Pennicetum purpuroides*) 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_0) 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 kecernaan 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$^+$, Biocompleks-Zn, Kinerja, Kambing PE

ABSTRACT

SUPRIYATI, W. PUASTUTI, I G.M. BUDIARSANA and I-K. SUTAMA. 2012. Effect of Supplementations of Comin$^+$ and Zn-biocomplex on the performances of Ettawa Crossbred goats. *JITV* 17(4): 290-296.

Digestibility of ruminant feeds is greatly determined by ruminal fermentation which in turn is greatly affected by micro-ecology 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) and Zn-biocomplex (R_2) alone or their combination (R_3) on performance 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 (*Pennicetum purpuroides*) *ad libitum* 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/d; and grass DM intakes from 304 g/d (R_0) became 373, 331 and 479 g/d for R_1, R_2 and R_3, respectively. Digestibilities of DM, NDF and DE/GE were not affected by supplementation, but supplementations significantly ($P < 0.05$) affected digestibilities of ADF and CP. Supplementation also significantly improved ($P < 0.05$) ADG from 65.18 g/d (R_0) became 94.64, 83.04 and 90.77 g/d; and FCR from 10.51 (R_0) became 7.82, 8.36 and 9.46 for R_1, R_2 and R_3, respectively. It was concluded that supplementation of Comin$^+$ (R_1) gave the best growth performance of Ettawa Croosbred goats, where ADG and FCR improved by 45.20% and 34.40%.

Key Words: Supplementation, Comin$^+$, Zn-biocomplex, Performances, Goats

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 sinthesis (UNDERWOOD and SUTTLE, 1999) and are inherently linked to health (DARMONO, 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 ricestraw-concentrate 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^o east longitude, in the 6^o 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^{o}C in the afternoon and the mean minimum temperature ranging from 18 to 23^{o}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 conncentrate at 10% inclusion. Zinc-biocomplex was prepared by semi solid fermentation of inorganic Zn salt in corn gluten meal using Saccharomyces cereviciae 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 gotas per treatment). The basal diets consisted of concentrate enriched with 3% AOFC and King grass (*Pennicetum purpuroides*). Treatments consisted of R_0) control (no supplementation), supplementation with R_1) Comin $^+$ (10% in concentrate), R_2) Zn-biocomplex (25 mg Zn/ kg concentrate) and R_3) 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.

Table 1. Chemical composition of feeds

Nutrients	King Grass	Diets			
		R_0	R_1	R_2	R_3
CP (%)	10.51	17.29	18.66	17.91	18.53
GE (kcal/kg)	3665	3871	3996	3949	4060
NDF (%)	71.03	28.44	28.52	28.97	28.27
ADF (%)	49.35	14.77	15.22	14.78	14.81

Animal management

At the beginning of the experiment all animals were dewormed with antihelmintic 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 equiped 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 accreditated 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 R_0, R_1, R_2 and R_3, 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 R_0, R_1, R_2 and

R_3 respectively). Further analysis showed that all treatments were significantly higher than control. There were also significant differences between treatments. The Comin+ supplementation (R_1, 373 ± 94 g/d) was more significant in dry matter intake of grass than control and Zn-biocomplex supplementation. The grass intake for R_2 (goat supplemented by Zn-biocomplex) was 331 ± 45 g/d, which was similar to previous study on local sheep (SUPRIYATI and HARYANTO 2007; SUPRIYATI 2008), and was significantly ($P < 0.05$) higher than control (R_0, 304 ± 59 g/d). The combine supplementation, Comin+ and Zn-biocomplex was further increased significantly ($P < 0.05$) above Comin+ or Zn-biocomplex alone. This observation suggested that there was an additive effect of Comin+ and Zn-biocomplex. The increased grass consumption due to mineral supplementations, might be due to better composition of its mineral supplied in the rumen, the consumption of grass is limited by the deficiency of minerals and nitrogen (HARYANTO *et al.*, 2006; LITTLE *et al.*, 1989; PUASTUTI *et al.*, 2012). Similar results in sheep were found by PUASTUTI *et al.* (2006), 72.2 and 55.3 g DM/LWT $(kg)^{0.75}$ for diets based on grass and concentrate with or without Comin block+ (enriched with fish meal) respectively and WILSON and MATHIUS (2006), 752 and 684 g DM/kg for diets based on grass and concentrate with or without Comin block+ (enriched protected protein with liquor of banana trunk). These similar results might be due to the same material used in Comin+, eventhough the ingredients used for enrichment were different, at present study and PUASTUTI *et al.* (2012) using fish meal while WILSON and MATHIUS (2006) using protected soybean. Furthermore, FAFTINE and ZANETTI (2011) found that multinutrient block supplementation increased total intake of dry matter (520 versus 279 g/day).

From these results can be conluded 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 diffrences 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+ (R_1 vs R_0), and Zn-biocomplex supplementation alone (R_2 vs R_0) or in combination with Zn-biocomplex (R_3 vs R_0). 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

Parameter	Treatments			
	R_0	R_1	R_2	R_3
Grass				
DM (g/d)	304 ± 59^d	373 ± 94^b	331 ± 45^c	479 ± 117^a
Concentrate				
DM (g/d)	381	373	378	379
Total Feed				
DM (g/d)	685 ± 65^d	748 ±103^b	711 ± 49^c	858 ± 128^a
CP (g/d)	97.85 ± 6.82^d	109.00 ± 10.82^b	102.69 ± 5.12^c	120.55 ± 13.48^a
ME (kcal/kg)	1865 ± 171^d	2063 ± 272^b	1954 ± 129^c	2371 ± 339^a
NDF (g/d)	327 ± 47^d	375 ± 74^b	349 ± 35^c	451 ± 92^a
ADF (g/d)	207 ± 32^d	242 ± 51^b	220 ± 24^c	303 ± 63^a

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

Table 3. Effect of Comin+ and Zn-biocomplex on apparent nutrient digestibility

Parameter	Treatments			
	R0	R1	R2	R3
DM (%)	72.09 ± 1.92	71.41 ± 3.87	71.62 ± 4.87	73.26 ± 4.30
NDF (%)	62.48 ± 4.78	64.63 ± 4.53	65.41 ± 3.86	67.03 ± 4,70
ADF (%)	57.82 ± 4.68b	68.63 ± 3.68[a]	65.51 ± 3.76[a]	66.56 ± 4,89[a]
DE/GE (%)	72.69 ± 1.81	73.77 ± 3.61	76.31 ± 4.07	76.06 ± 3,82
CP (%)	75,40 ± 1.34b	78,52 ± 3.07[a]	80,26 ± 3.23[a]	81.60 ± 2.85[a]

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

Effect of Comin+ and Zn-biocomplex on goat performance

The effect of treatments on performance of experimental goats is 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 (R_0: 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 R_1, R_2 and R_3 treatments, respectively. It means that ADG of supplemented groups improved by 45.20, 39.26 and 42.23% for R_1, R_2 and R_3, compared to control (R_0). The ADG between the supplemented groups, R_1 was similar to R_3 and both were higher than R_2. This difference could be due to the presence of fish meal in Comin+ (in R_1 and R_3) but not in Zn-biocomplex. These findings were similar to those reported by PUASTUTI (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 supplementations is presented in Graph 1. The regression equations for R_0 = 0.491x + 17.13 (r^2 = 0.971), R_1 = 0.686x + 15.87 (r^2 = 0.993), R_2 = 0.607x +16.63 (r^2 = 0.996) and R_3 = 0.669x + 15.41 (r^2 = 0.993). The regression equations showed that the fastest growth rate occured at diet R_1, followed by R_2, R_3 and R_0. The regression equations for all treatments were linear indicating that the measurements was in the periode of accelerated growth phase.

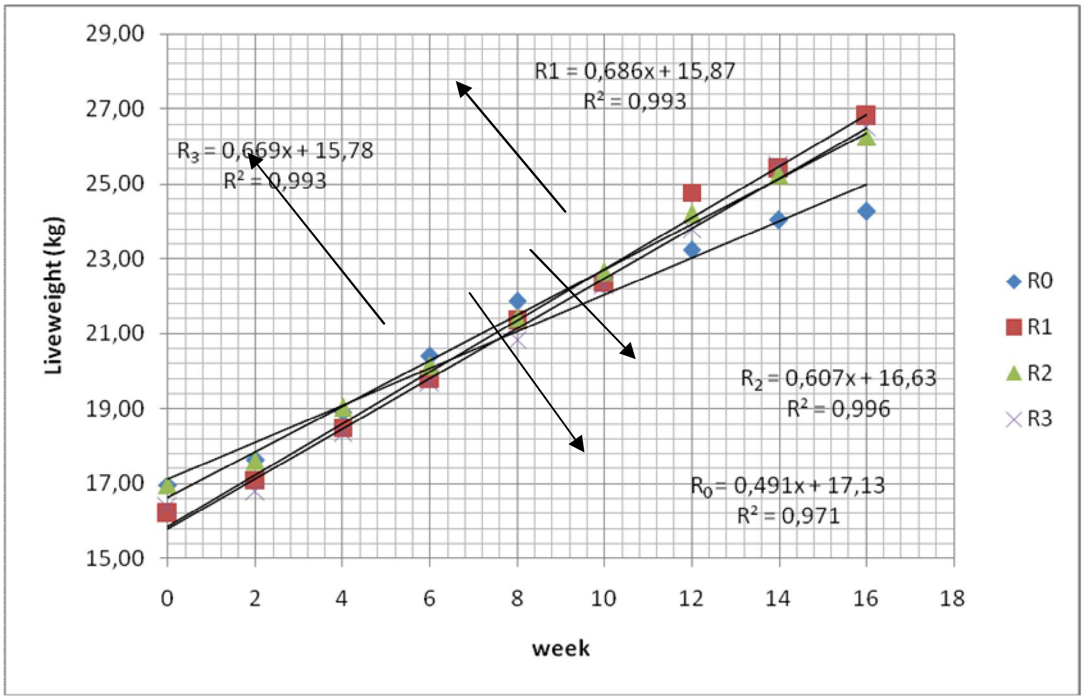
At the end of feeding trial (16 weeks), the liveweight of supplemented groups were similar, 26.80; 26.27 and 26.53 kg for R_1, R_2 and R_3 treatments, respectively and all were significantly (P < 0.05) heavier than control (R_0 = 24.27 kg).

The feed efficiency (FCR = DMI/ADG) values were also significantly affected by supplementations. The FCR value of control (R0 = 10.51) were significantly higher than the one fed supplement 7.82, 8.36 and 9.46 for R_1, R_2 and R_3, respectively. There was also significant (P < 0.05) differences between supplementations (Table 4). Feed efficiencies of supplementations (R_1, R_2 and R_3) 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 $ZnSO_4$ 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

Parameter	Treatments			
	R0	R1	R2	R3
Initial liveweight,kg	16.97 ± 1.37	16.20 ± 3.44	16.97 ± 2.18	16.37 ± 1.07
Final liveweight, kg	24.27 ± 2.24[b]	26.80 ± 2.55[a]	26.27 ± 2.82[a]	26.53 ± 1.39[a]
ADG, g/d	65.18 ± 11,99[c]	94.64 ± 10,89[a]	83.04 ± 12.96[b]	90.77 ± 14.44[a]
FCR (DMI/ADG)	10.51± 1.34[d]	7.82 ± 0.97[a]	8.36 ± 0.50[b]	9.46 ± 0.76[c]

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). Supplementations of Comin+ gave the best performance of goats, indicated by the improvement of ADG and FCR values by 45.20% and 34.40%.

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