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Effect of Different Levels of Complex Probiotics on Local Goat Kids' Performance

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ABSTRACT

The study included 18 male of local goats at the age of three months with an average weight of 16.17±1.10 kg. The lambs were randomly distributed to six treatments with two levels of concentrated feed (40 and 60%) and three levels of probiotics (0, 2.5 and 5 g/head/day). The probiotics included *Lactobacillus acidophilus* 10^8, *Bacillus subtilis* 10^9, *Bifidobacterium* 10^8 and *Saccharomyces cerevisiae* 10^9. The results showed significant improvement in body weight (20.76, 24.72 and 26.26 kg) for the group fed only on 40% concentrate without probiotics, 40% concentrate plus 2.5 g probiotics and 60% concentrate plus 2.5 g probiotics, respectively; and daily weight gain (52.89, 96.89 and 107.33 g/day, respectively). The significant superiority was observed in the feed efficiency of the diets with 2.5 or 5 g head/day of probiotics (8.77, 4.97 and 4.05 kg feed/kg weight gain, respectively). There was also significant superiority in the digestibility coefficient of dry matter, organic, crude protein, acid detergent fiber and ether extract of probiotics nutrient groups. In conclusion, adding either 2.5 or 5 g probiotics/head/ day for kids ration enhanced overall performance of local goat kids.

Key words: Probiotics, local goat kids, levels, performance

INTRODUCTION

Local goats suffer from low productivity due to the lack of feed, low nutritive value and genetic composition (Hegde, 2019). Nutrition contributes more than 60% of the costs of animal breeding and production (Al-Galbi *et al.*, 2017). The performance of animals can be swiftly improved by boosting nutrition and studies have shown that the best strategy to prevent harmful side effects for the animal is to employ essential treatments to improve feed, especially roughage (the most abundant) feed like rice hay (Makkar, 2018; Salami *et al.*, 2019).

Probiotics have been widely used in ruminants feeding to improve nutrient digestion, animal performance and health status (Cai *et al.*, 2021a). Probiotics also contributed to reducing the negative effects of heat stress on animal performance and productivity (Cai *et al.*, 2021a; Shah *et al.*, 2020). The use of probiotics also improved the environment and fermentation of the rumen and thus increased the digestibility of feed and improved the performance and growth of ruminants (Cai *et al.*, 2021b). Sivadasan and Subramannian (2020) found the addition of *S. cerevisiae, L. acidophilus* and *P. freudnreichii* had significant impact on final kid body weights and total growth rate (16.20 and 13.32 kg) for the treated and control group, respectively.

Al-Ghazi (2022) noted a significant improvement in the weights and growth rate of the of the Iraqi local goat kids at the age of six months, when the diets supplemented with probiotics consisting of some species of bacteria, fungi and bread yeast. However, Saleem *et al.* (2017) found that adding probiotics to lambs pre- and post-weaning had no detectable impact on the rate of daily and overall weight gain and the amount of feed consumed, but that there was a noticeable rise in the digestion coefficient of dry matter, organic matter, crude protein and free nitrogen extract. The present study aimed at finding out the effect of adding different levels of probiotics and levels of concentrated feed on the performance of local Iraqi goat kids.

MATERIALS AND METHODS

This study was conducted in the field of a goat breeder in the area of Karmachi, Karma Bani Saeed district, Souk Al-Shuyoukh district, Thi-Qar Governorate for 105 days, including 15 days preliminary period. A total of 18 local male kids employed in an individual feeding trial, with an average age of three months and weight of 16.17 kg. Kids were divided into six nutritional groups (3 kids each), fed a concentrated diet consisting of (20% wheat flour, 25% wheat bran, 25% barley, 20% crushed corn, 7% soybean meal and 3% salts and vitamins) with rice hay treated with molasses and urea. The 1st diet group was control (T_1), 0 g probiotics/head/day in addition to (40% concentrate + 60% rice straw). The 2nd group (T_2) was given 2.5 g probiotics/ head/ day in addition to (40% concentrate + 60% rice straw). The 3rd group (T_3) was given 5 g probiotics/head/day in addition to (40% concentrate + 60% rice straw). The 4th group (T_4) was given 0 g probiotics/head/day in addition to (60% concentrate + 40% rice straw). The 5th group (T_5) was given 2.5 g probiotics/ head/day in addition to (60% concentrate + 40% rice straw). The 6th group (T_6) was given 5 g probiotics/head/day in addition to (60% concentrate + 40% rice straw). The lambs fed the concentrated diet as 3% of their body weight. Chemical analysis of concentrate diets and rice straw is shown in Table 1. The animals were examined by the veterinarian and all veterinary procedures were taken throughout the study period, as the kids dosed against intestinal and hepatic worms using Al-Bendazole produced by the Italian Company Doxal at a dose of 150 mg/kg live weight. The kids were also injected with Ivermctine (0.21 cm^3/ 10 kg live weight) produced by the English Company Norbrook, subcutaneously.

Table 1. Chemical analysis of experimental diets

Nutrients	Concentrate (%)	Rice straw (%)
Dry matter	92.00	88.5
Crude protein	15.89	4.90
Ether extract	3.25	1.92
Crude fiber	6.99	29.23
NFE	70.81	40.95
Ash	3.06	11.50
NDF	21.76	73.60
ADF	6.15	64.90
ADL	3.56	25.70
Hemicellulose	15.61	8.70
Cellulose	2.59	39.20

Throughout the course of the study, the animals' weights were measured at the end of each month, and daily and overall weight gains were determined. The difference between the daily amount of feed remaining and the amount delivered to the animal was used to determine feed consumed. In order to calculate the coefficient of digestion of nutrients, feces from each animal were collected prior to feeding, mixed thoroughly, and weighed. A sample of 10% of the total weight of feces was then taken, packed in polyethylene bags, and kept at a temperature of -15°C until the end of the collection period. After that, all of the samples from each animal were combined, dried and three samples weighing 10 g were taken for chemical analysis. Every day, each animal's leftover feed was also gathered and weighed.

The daily weight gain rate, feed conversion ratio and digestion coefficient were calculated as follows:

The daily weight gain rate = subsequent weight – (previous weight/subsequent time) - previous time

Feed conversion ratio = amount of feed consumed during the period (g)/weight gain during the same period (g)

Apparent digestion coefficient % = [(Amount of food consumed – Amount of nutrient excreted in waste)/Amount of feed consumed]×100

The statistical program SPSS (2012) was used to analyze the data using a single factor randomized design of six treatments and test for significant differences among means using the revised least significant differences (RLSD).

RESULTS AND DISCUSSION

Body weight was significantly affected by the ratio of concentrated diet and the addition of probiotics (Table 2). The kids in the third month of the study recorded 24.72 and 26.26 kg for the two groups fed on 40 or 60% concentrated feed in addition to 2.5 g probiotics/head/day, respectively. While the weight of kids fed on 40% concentrated feed without the addition of probiotics was only 20.96 kg. Thus, the kids fed on 40 or 60% concentrated and added to 2.5 g probiotics/ head/day outperformed the fed (40%) concentrated diet without additives.

Table 3 shows the average daily and total weight gain of kids fed on 40 or 60% concentrated diet with the addition of 2.5 or 5 g probiotics/head/day. The daily gain of kids that were fed 60% concentrated diet with 2.5 g probiotics/head/day) was significantly higher 107.33 g/day than those of the rest groups.

Table 2. Means of initial body weight and weights at different months of kids fed different level of roughages and probiotics

Treatment	Initial body weight	Weight at month		
		1st	2nd	3rd
T_1	16.20±1.10	17.12±0.65c	19.04±0.60c	20.96±0.59c
T_2	16.00±1.15	19.57±0.60ab	22.14±0.53b	24.72±0.52b
T_3	15.90±1.08	18.53±0.62b	21.16±0.56b	23.79±0.55b
T_4	16.50±1.12	19.49±0.63ab	22.00±0.57b	24.25±0.56b
T_5	16.60±1.17	19.75±0.64a	23.37±0.58a	26.26±0.57a
T_6	15.80±1.16	18.50±0.58b	22.18±0.54b	24.86±0.53b

Different letters differ significantly at P=0.05 level.

Table 3. Mean of daily gain (g) and total gain (kg) of kids fed different levels of roughages and probiotics

Treatment	Daily gain	Total gain
T_1	52.89±7.99c	4.76±0.87c
T_2	96.89±7.88b	8.72±0.70a
T_3	87.67±7.90b	7.89±0.73b
T_4	86.11±7.95b	7.75±0.75b
T_5	107.33±8.02a	9.66±0.90a

Different letter differ significantly at P=0.05 level.

While the group fed on 40% concentrated diet only recorded the lowest 52.89 g/day value. Kids fed either 40 or 60% concentrate diet supplied either with 2.5 or 5 g/head/day of probiotics exhibited similar growth rate.

In the case of total weight gain kids fed 40 or 60% concentrate diet in addition to 2.5 g probiotics/head/day or 60% concentrate diet in addition to 5 g probiotics/head/day exceeded the rest groups. The group that consumed a 60% concentrated diet together with 2.5 g of probiotics/head/day gained the highest weight gain 9.66 kg, while the 40% concentrate diet group gained just 4.76 kg.

According to these findings, the goats' overall weight gain increased by a factor of two when probiotics were added in comparison with the group that just received a 40% concentrate diet. Adequate intake of probiotics improved goat growth (Angulo *et al.*, 2019; Taboada *et al.*, 2022). When goats were given probiotic supplements, Cai *et al.* (2021a, b) observed an improvement in their growth even they were under heat stress. Saleem *et al.* (2017) found that lamb weights improved when probiotics were added to the diet, and they attributed this improvement to higher feed or dry matter intake, nutritional conversion efficiency, and nutrient digestion. Chaucheyras-Durand *et al.* (2019) and Hassan *et al.* (2020) observed improved growth of lambs and goats as a result of changing the types of rumen microorganisms and the availability of the necessary nutrients (carbon and nitrogen) for their growth with an appropriate pH.

The current study's findings are in agreement with those of Sivadasan and Subramannian (2020), who utilized a variety of probiotics to significantly boost Malabari goat kid's final body weight as well as their overall and daily weight gain rates. Overall, improvements in animal growth and weight gain have been obtained as a result of the addition of probiotics to their diets through increased feed intake (Seifzadeh *et al.*, 2017; Rehman *et al.*, 2020), nutritional conversion efficiency (Saleem *et al.*, 2017) or direct increase in body weight (Hussein, 2014). The positive effect of the probiotics may be due to improved activity of cellulolytic bacteria through increased fiber breakdown (Retta, 2016) and increased microbial protein synthesis, resulting in increased amino acid processing in the small intestine (Shin *et al.*, 2019). Probiotics also stick to the mucous membrane of the colon, which results in improved nutrient digestion and potential increases in dry matter intake by preventing the existence of pathogenic bacteria (Ruiz Sella *et al.*, 2021).

Table 4. Means of feed conversion ratio and feed intake of kids fed different levels of roughages and probiotics

Probiotic (g)	Feed conversion ratio (kg feed/kg gain)	Feed intake (kg)
T_1	8.77±0.62c	41.76±5.00a
T_2	4.97±0.65a	43.31±4.75a
T_3	5.59±0.63b	44.11±5.08a
T_4	4.95±0.58a	38.48±4.55a
T_5	4.05±0.68a	39.14±4.60a
T_6	3.99±0.56a	36.19±4.25a

Different letters differ significantly at P=0.05 level.

Table 5. Digestion coefficient of feed nutrients of different treatments

Treatment	Dry matter	Organic matter	Crude protein	Ether extract	Soluble carbohydrates	(Acid detergent fiber, ADF)	(Neutral detergent fiber, NDF)
T_1	64.04±3.70c	65.41±3.10c	65.37±3.11c	71.00±4.90c	76.52±5.92a	28.20±3.25b	26.10±3.22a
T_2	71.75±3.80b	74.13±3.30b	72.09±3.10b	81.72±4.93b	79.92±5.56a	34.92±3.33a	29.82±3.32a
T_3	72.34±3.95b	72.74±3.45b	71.80±2.85b	80.43±4.99b	78.63±5.76a	34.63±3.27a	28.53±3.18a
T_4	73.27±4.10a	79.66±3.55a	74.72±3.20a	87.35±5.19a	85.55±5.44a	34.80±3.39a	27.70±3.24a
T_5	78.58±3.88a	84.98±3.22a	80.04±3.14a	89.52±5.12a	87.44±5.65a	36.16±3.50a	29.94±3.21a
T_6	75.76±3.92a	82.16±3.44a	78.48±3.18a	88.88±5.22a	87.08±5.78a	34.28±3.35a	28.00±3.29a

Different letters differ significantly at P=0.05 level.

The amount of feed intake was not affected by the different treatments, while the feed conversion efficiency was significantly affected by adding 2.5 g probiotics/head/day to each of the fed groups (40 or 60%) concentrated diet (Table 4). As observed in present study, the consumption of probiotics improved feed conversion efficiency by prolonging the time that feed components spent in the digestive tract and their exposure to microbial activity (Krysiak *et al.,* 2021). The interplay of the probiotics, the level and kind of diet, the rumen's microorganism species and the increased microbial culture with those factors, as well as the rumen's improved pH, may be responsible. Research has demonstrated that bio-treatment of roughage feeds improved palatability, raised digestibility coefficient and boosted feed intake (Al-Galiby, 2015).

The digestibility coefficients of dry matter, organic matter, crude protein, ether extract and acid detergent fiber were significantly affected by adding the probiotics by 2.5 or 5 g/head/day (Table 5). The digestibility of dry matter increased when increasing the percentage of concentrated feed and the addition of probiotics, and the fifth treatment (T_5) recorded (78.58%). While the treatment in which (40% concentrate) used diet recorded only (64.04%). Organic matter, crude protein and ether extract all responded similarly during digestion as dry matter. However, acid detergent fiber in every group that had a concentrated diet (40 or 60%) together with various amounts of probiotics exceeded the kid's group that received only a (40%) concentrated diet.

Current results are consistent with those found by Saleem *et al.* (2017) when using the probiotics in feeding lambs who found improvement in dry matter, organic matter, crude protein, crude fiber and nitrogen-free extract digestibility when the probiotics was added to the lamb diets with high levels of concentrated feed.

The reason may be due to an increase in the effectiveness and numbers of cellulolytic bacteria with improved pH (Li *et al.*, 2019). The addition of probiotics to weaned lambs (Khattab *et al.*, 2020) did not significantly affect dry matter, organic and crude protein compared to the control group. The difference in these results may be due to the type of animal, the environment, the method of using the probiotics, its level and types.

CONCLUSION

With addition of complex probiotic, there was also significant superiority in the digestibility coefficient of dry matter, organic, crude protein, acid detergent fiber and ether extract of probiotics nutrient groups. In conclusion, adding either 2.5 or 5 g probiotics/head/day for kids ration enhanced overall performance of local goat kids.

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